Status of the Chilipepper Rockfish, *Sebastes goodei*, in the California Current for 2015

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EXECUTIVE SUMMARY

Stock

The stock boundary for the 2007 chilipepper rockfish assessment, and for this update, is the U.S./Mexico border in the south, to the Columbia River in the north.

Catches

Chilipepper Rockfish have long been one of the most important targets of California commercial rockfish fisheries (including trawl, hook and line and setnet gears), and a fairly important component of recreational fisheries, with total catches ranging from 2500 to 3500 tons from the mid-1970s through the early 1990s. However, since the mid-1990s catches have been greatly reduced as a consequence of trip limit reductions and area closures implemented to reduce catches and rebuild populations of overfished species, particularly bocaccio and canary rockfish, which often co-occur with chilipepper. Over the past five years, catches have averaged approximately 350 tons per year, primarily from bottom trawl fisheries (Figure E1).

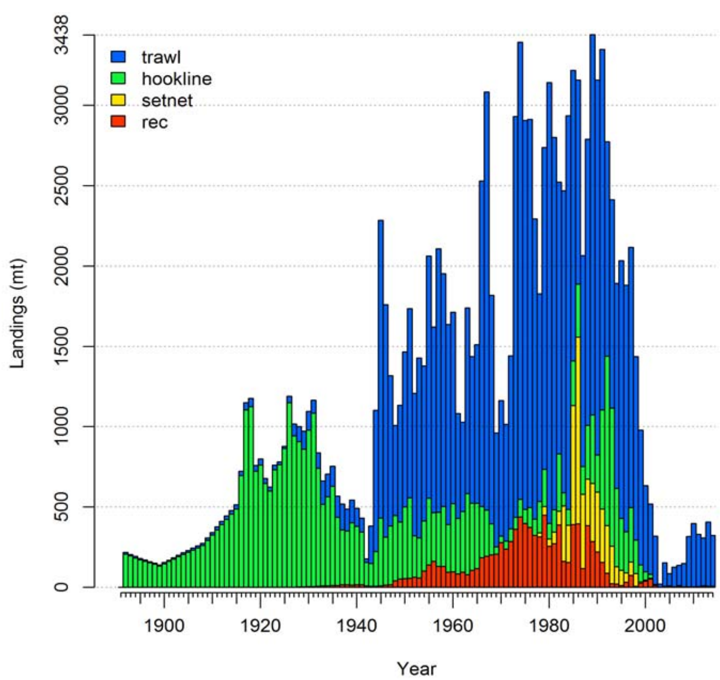

Figure E1: Catches by fishery for chilipepper rockfish over the past 120 years

Data and Assessment

The 2015 chilipepper update maintains the same fundamental model structure as the 2007 assessment. New estimates of historical catch data from catch reconstructions were included in the model. Commercial and recreational age and length composition data from 2007-2014, as well as a revised NWFSC bottom trawl survey index, and a revised pelagic juvenile survey abundance index (as an indicator of year class strength) were included in the update. Age composition data not available in 2007, primarily from bottom trawl surveys, were included. Some refinements to life history data (relative fecundity, maturity relationship) were also made. Most data revisions or additions had some influence on model estimates of stock status, but very few resulted in substantive changes to the model estimate of relative stock status. Steepness remains fixed at the point estimate used in the 2007 stock assessment.

Stock Spawning Output and Depletion

As a result of updating the fecundity relationship, spawning output is now reported in the 1000s of larvae produced, rather than spawning stock biomass. For the executive summary, relative depletion (larvae produced relative to the mean estimated unfished level of larvae produced) is reported. Since the strong 1999 year class, abundance has increased to above target levels.

Table E1: Spawning output, summary biomass and depletion for the base model in 2015

	Spawning Output (millions larvae)	St. Dev Spawning Output	Summary Biomass (age 1+)	Depletion
2005	4191	615	37226	0.594
2006	4499	660	37618	0.638
2007	4636	679	36720	0.657
2008	4617	675	34941	0.655
2009	4473	653	32952	0.634
2010	4274	627	30765	0.606
2011	4054	598	31219	0.575
2012	4013	594	33147	0.569
2013	4176	622	34643	0.592
2014	4364	661	35517	0.619
2015	*4515*	692	*36797*	*0.640*

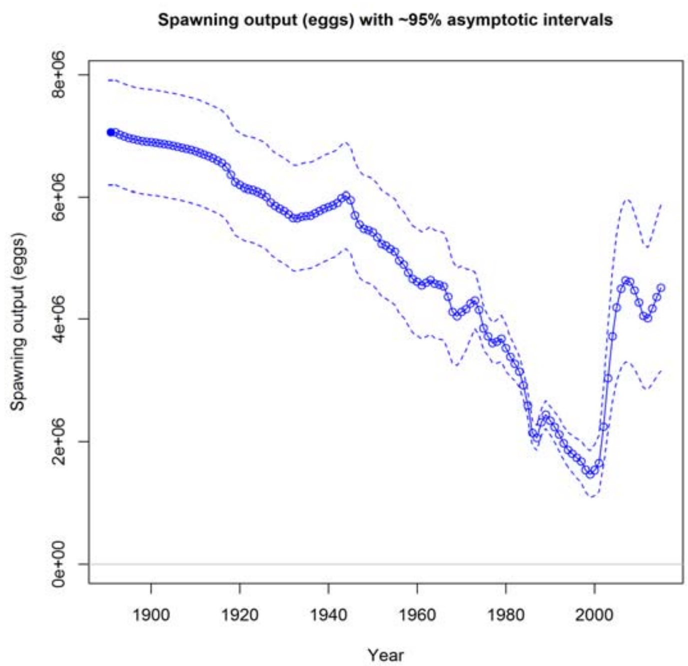

Figure E2: Spawning output (larvae, in 1000s) with approximate 95% confidence intervals

Recruitment

Recruitment for chilipepper rockfish is highly variable, with a small number of year classes tending to dominate the catch in any given fishery or region. As age and length data are only available for the late 1970s onward, estimates of year class strength are most informative from the 1970s to the present. The 1984 and 1999 year classes were among the strongest in that time period, however several very strong year classes have been observed in recent years (2009-2010, 2013-2014) and are already leading to a fast rate of increase in abundance and larval production.

Table E2: Recruitment estimates and CV of recruitment estimates for the base model

	Recruitment (1000s)	CV Recruitment
2005	3754	0.37
2006	4578	0.35
2007	14471	0.24
2008	12856	0.27
2009	88370	0.18
2010	61308	0.21
2011	13854	0.32
2012	17894	0.32
2013	47368	0.31
2014	69760	0.77
2015	*37810*	1.00

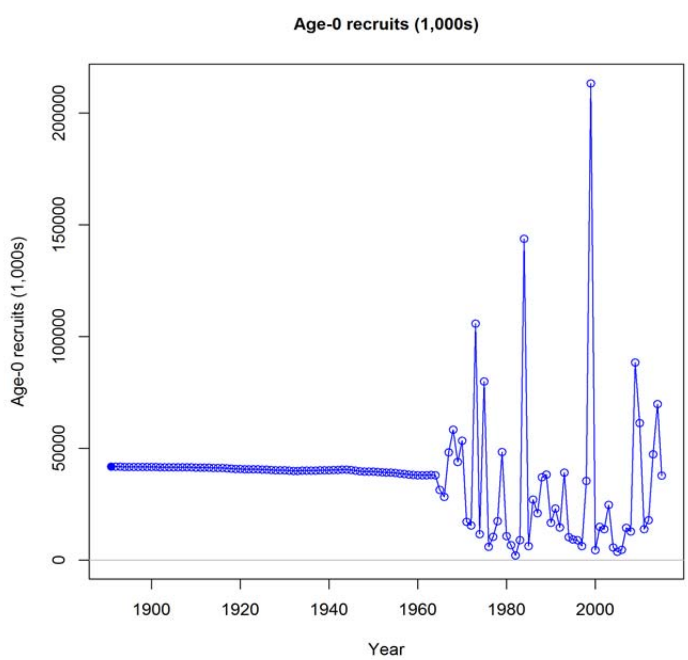

Figure E3: Recruitment estimates for the base model

Reference Points

Reference points, including estimates of yield under target SPR and relative biomass target levels, are reported in Table E3. The model estimated an unfished larval production (spawning biomass) (SSB0) of 7.05 billion larvae (labeled as eggs in figures), an unfished summary biomass of 54,578 tons, and a 2015 larval output of 4.5 billion larvae, which results in a relative depletion estimate of 64.0% (of the unfished spawning output). The summary biomass for 2015 was 36,797 tons, corresponding to 67.4% of the estimated unfished summary biomass. Estimates of equilibrium yields in the 2015 base model, which range from 2115 to 2165 metric tons (depending on whether SPR, SSB or MSY reference was used to estimate) are highly consistent with those from the 2007 assessment (2099 to 2165 metric tons).

Table E3: Reference Points for the 2015 Base Model

	Estimate	St.Dev	Lower ~95% CL	Upper ~95% CL
SSB_Unfished (millions larvae)	7053	438	6615	7491
SmryBio_Unfished	54578	3375	51203	57953
Recr_Unfished	41817	2598	39219	44415

	Yield	Depletion	SSB	SPR	F
Btarget	2136	0.400	2821	0.485	0.082
SPR target	2115	0.420	2963	0.500	0.078
MSY	2165	0.339	2390	0.438	0.095

Exploitation Status and Management Performance

Since 2005, total catches have been well below the established ABC/OY (pre-2011) and ACL/OFL (post 2010) levels, and SPR and exploitation rates have been correspondingly low through this period.

Table E4: Exploitation status and Management Performance, 2005- 2016

	OFL (ABC prior to 2011, south 40 10 only from 2011 onward)	ACL (OY prior 2011) south of 40 10 only from 2011 onward	Chilipepper contribution to minor shelf rock north (OFL), 2011 onward	Total Catch	Catch as % of combined OFL	SPR	Exploitation Rate
2005	2,700	2,000		85	0.03	0.976	0.002
2006	2,700	2,000		126	0.05	0.967	0.003
2007	2,700	2,000		137	0.05	0.964	0.004
2008	2,700	2,000		148	0.05	0.961	0.004
2009	3,037	2,885		318	0.10	0.917	0.01
2010	2,576	2,447		397	0.15	0.891	0.013
2011	2,073	1,981	156.0	331	0.16	0.901	0.011
2012	1,872	1,789	140.9	307	0.16	0.904	0.009
2013	1,768	1,690	133.1	405	0.23	0.880	0.012
2014	1,722	1,647	129.6	325	0.19	0.908	0.009
2015	1,703	1,628	*129.6*				
2016	1,694	1,619	*129.6*				

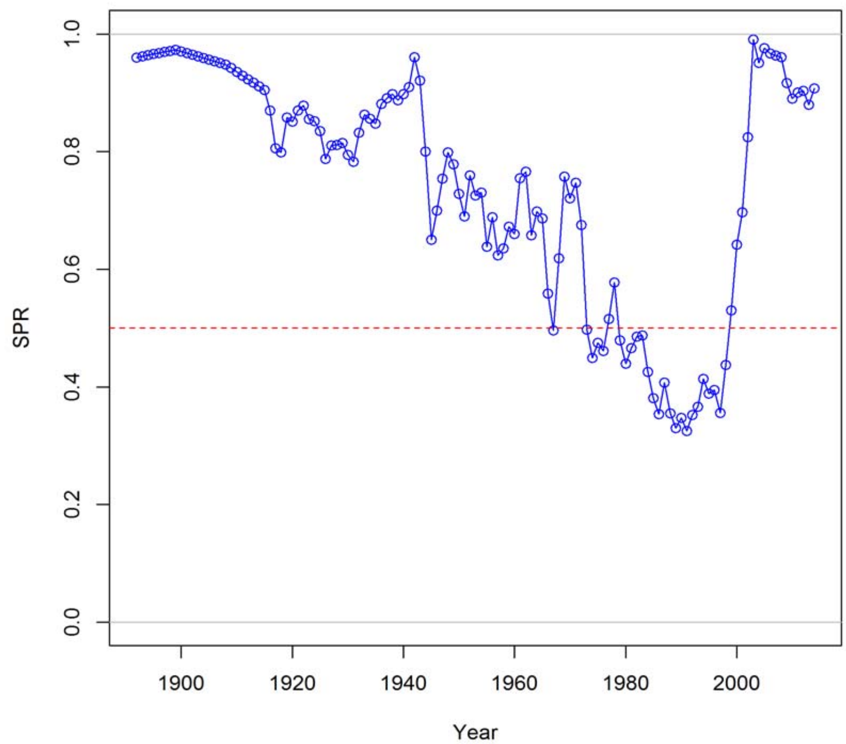

Figure E4: Model estimated Spawning Potential Ratio (SPR)

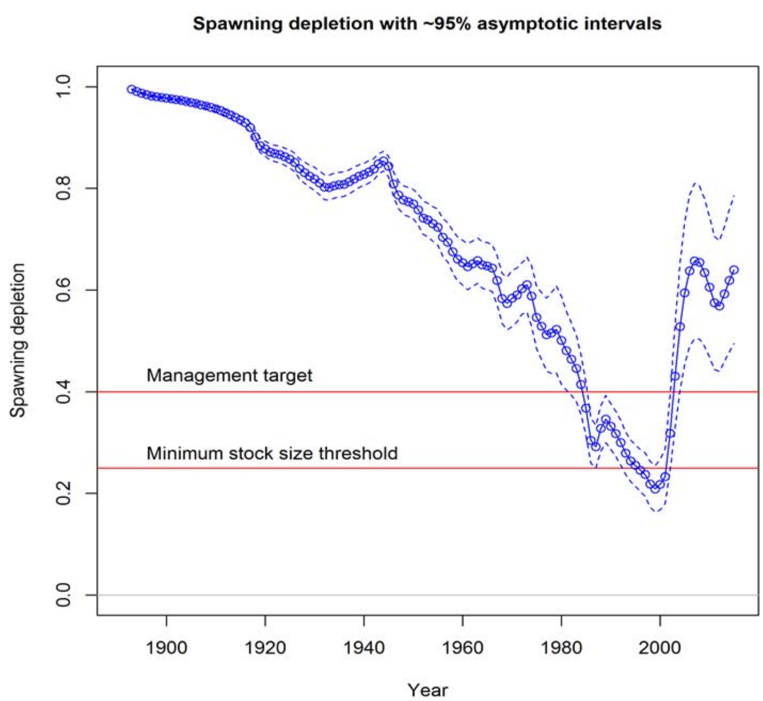

Figure E5: Depletion estimate with reference points and approximate 95% confidence intervals

Forecast

As the current spawning output is above target levels, catches have been below target levels, and several strong year classes are contributing to a forecast for high biomass. The forecast ACL and OFL levels (for 2017 onward, assuming 2015-2016 catches are achieved as adopted for that management cycle) are greater than the equilibrium catch levels reported in Table E5.

Table E5: Base model estimates of 2017-2026 ACL and OFL levels, assuming 2015-16 catches are achieved at set ACL levels

	Base model ACL catches (existing 2015-16)	Base model OFL catches (existing 2015-16)	Depletion (assuming ACL)
2015	*1758*	*1833*	0.64
2016	*1749*	*1824*	0.62
2017	2803	2932	0.62
2018	2707	2820	0.6
2019	2671	2773	0.58
2020	2635	2727	0.57
2021	2583	2666	0.55
2022	2521	2595	0.54
2023	2457	2525	0.52
2024	2397	2458	0.51
2025	2343	2399	0.5
2026	2294	2346	0.49

Unresolved Problems and Major Uncertainties

A number of technical issues discussed in the review of the 2007 model have not yet been resolved in this update (as resolution will require changes to model structure outside of the terms of reference for assessment updates). These include how weightings were assigned for length and age composition data, how the time varying growth is estimated, the length bin structure, and selectivity parameterization issues for both fisheries and fishery independent surveys. Steepness remains a key uncertainty. Interestingly, when profiled or estimated with a prior, the model has a slightly better fit with lower steepness values (approximately 0.4), in contrast to the results of the 2007 model, which had a better fit with higher steepness values.

Decision Table

The decision table follows the 2007 assessment format, with the two alternative states of nature equating to low (steepness set to 0.34) and high (steepness set to 0.81) productivity assumptions. Catches are based on either the status quo for the "low" catch scenario (average catch over the past 5 years), on the adopted 2015-2016 ACLs and forecast 2017-2026 ACLs for the moderate catch level, and the combined 2015-2016 ACLs and forecast 2017-2026 OFLs for the "high" catch level. As chilipepper is considered a category 1 stock with a P* = 0.45 in recent years (translating to a 4.4% buffer for the ACL to be set below the OFL), the difference between ACL and OFL catch streams is not terribly large. Recent year average catch seems a good low end catch stream for the decision table. Under the base and high productivity scenarios, none of these catch streams lead to conservation concerns, however under the low productivity scenario (h=0.34), the stock rebuilds to target levels with status quo catches, but declines below the overfished threshold by 2019 with ACL or OFL catches.

Table E6: Decision Table

		State 1 (h=0.34)		Base (h=0.57)		State 2 (h=0.81)	
Year	Status quo catches	larvae (millions)	depletion	larvae (millions)	depletion	larvae (millions)	depletion
2015	346	2985	0.32	4515	0.64	4926	0.79
2016	346	2991	0.32	4590	0.65	5001	0.80
2017	346	3027	0.33	4742	0.67	5150	0.83
2018	346	3088	0.33	4935	0.70	5332	0.86
2019	346	3165	0.34	5121	0.73	5494	0.88
2020	346	3248	0.35	5285	0.75	5623	0.90
2021	346	3336	0.36	5424	0.77	5718	0.92
2022	346	3426	0.37	5542	0.79	5785	0.93
2023	346	3516	0.38	5641	0.80	5829	0.93
2024	346	3607	0.39	5725	0.81	5855	0.94
2025	346	3698	0.40	5797	0.82	5868	0.94
2026	346	3789	0.41	5859	0.83	5872	0.94
	ACL catches	larvae (millions)	depletion	larvae (millions)	depletion	larvae (millions)	depletion
2015	1758	2997	0.32	4515	0.64	4901	0.79
2016	1749	2801	0.30	4387	0.62	4784	0.77
2017	2803	2645	0.28	4346	0.62	4750	0.76
2018	2707	2378	0.26	4210	0.60	4607	0.74
2019	2671	2162	0.23	4104	0.58	4481	0.72
2020	2635	1976	0.21	4000	0.57	4346	0.7
2021	2583	1809	0.19	3894	0.55	4203	0.68
2022	2521	1651	0.18	3789	0.54	4060	0.65
2023	2457	1500	0.16	3689	0.52	3923	0.63
2024	2397	1353	0.15	3597	0.51	3796	0.61
2025	2343	1206	0.13	3514	0.50	3681	0.59
2026	2294	1060	0.11	3439	0.49	3581	0.58
	OFL catches	larvae (millions)	depletion	larvae (millions)	depletion	larvae (millions)	depletion
2015	1758	2995	0.32	4515	0.64	4926	0.79
2016	1749	2806	0.30	4387	0.62	4798	0.77
2017	2932	2655	0.29	4346	0.62	4755	0.76
2018	2820	2372	0.26	4192	0.59	4586	0.74
2019	2773	2143	0.23	4071	0.58	4442	0.71
2020	2727	1946	0.21	3954	0.56	4293	0.69
2021	2666	1768	0.19	3838	0.54	4141	0.66
2022	2595	1602	0.17	3725	0.53	3991	0.64
2023	2525	1444	0.16	3619	0.51	3849	0.62
2024	2458	1289	0.14	3521	0.50	3720	0.60
2025	2399	1136	0.12	3434	0.49	3605	0.58
2026	2346	983	0.11	3356	0.48	3504	0.56

C. INTRODUCTION

This update stock assessment maintains the same spatial and temporal structure as the 2007 assessment (except, of course, that the end year is extended 8 years to 2014 rather than 2006), and the 2007 assessment should be referred to for details regarding any data or model aspect not updated or re-analyzed for this update. Moreover, dataset descriptions, diagnostics and model fits are included only for time series and datasets that were extended in this update, as the model results and fits for other time series changed only modestly for these datasets. However, complete sets of all model results and diagnostics (e.g., the "r4ss" outputs) for either the base model or for any intermediate or sensitivity runs are available on request in pdf format.

The Latin name for chilipepper rockfish, *Sebastes goodie*, honors that 19th century ichthyologist and fisheries biologist David Brown Goode (Love et al. 2002), while the common name was derived from the observation that long strings of these bright red fish resemble a string of drying chilis (Davis 1978). They have been one of the most important commercial target species in California waters since the 1880s, particularly in central California. The distribution ranges from Queen Charlotte Sound (British Columbia) to Bahia Magdalena (Baja California Sur), however the region of greatest abundance is found between Point Conception and Cape Mendocino, California. The stock boundary for the 2007 assessment and for this update is the U.S./Mexico border in the south, to the Columbia River (Oregon/Washington border) in the north (north of which chilipepper are very uncommon). Adult fish tend to be most abundant in large schools between 100 and 300 meters, often in midwater.

Growth, Maturity and Fecundity

The 2007 assessment included time varying growth, manifest by the estimation of "offset" parameters to the von-Bertalanffy growth coefficient (K). This is maintained in this assessment, and alternative configurations to the time blocks are discussed in the modeling section. Note that the addition of very large numbers of survey age estimates, for both the triennial trawl survey (1983, 1992, 1998 and 2001) and the combined bottom trawl survey (2003-2014, only 2004 age data were available in the 2007 assessment) have a strong influence on the temporal growth variability trends observed in the model. Possible regional differences in growth, between Southern and Central California in particular, may complicate the ability of the model to best detect temporal patterns. A more comprehensive evaluation of the drivers and consequences of variable growth in this population is beyond the scope of this update, but is anticipated as key to ongoing research efforts for this species.

Maturity and fecundity parameters were re-examined in light of newly available data collected from ongoing reproductive ecology studies (Beyer et al. 2015). For fecundity, over 200 samples were taken from a range of locations throughout the range of chilipepper rockfish in the period from 2009-2013 (sampling is ongoing, but more recent data are not yet included). Methods and results are described in Beyer et al. (2015), the fecundity relationship from that publication was used to update the size-dependent fecundity relationship (from one of no relationship to one of a moderately strong relationship) in the assessment update. The size dependent fecundity relationship developed for chilipepper rockfish was not among the strongest (Figure 1); much stronger relationships are observed for Yellowtail Rockfish and Blackgill Rockfish. The effect of including these relationships in assessments on the perception of relative stock status and on other reference points has recently been evaluated using both these empirical examples and simulation studies (He et al. 2015), for which the overall impact on chilipepper relative stock status and associated reference points was fairly minor, while the effect on blackgill rockfish (a slower life history and stronger relative fecundity relationship) was substantial.

However, chilipepper rockfish (like bocaccio, cowcod, rosy and as many as 12 other generally southern *Sebastes* species) are also known to produce multiple broods, which could increase overall reproductive effort considerably. This phenomena has been the subject of recent investigations using both microscopic and histological methods (Beyer et al. 2015; also S. Sogard, S. Beyer, D. Stafford, N. Kashef, L. Lefebvre and J. Field; unpublished data). Over the past five years, secondary broods in chilipepper rockfish have been documented as common in most years in Southern California waters, starting in December, and there is some evidence of more than two broods in some individuals. In Central California, multiple broods have been less common, although in some years (such as 2013) the phenomena seemed to be more widespread. Assessments of total fecundity of second broods suggest that they are comparable to the size of the "first" broods (when the distinction can be made), however given the strong spatial and temporal variability in the phenomena, the extent to which multiple broods relate to the relative size or age of fish has not yet been fully resolved. Although females of all sizes appear to be capable of producing a secondary brood, current data suggest a greater frequency among mid- to larger sized females, a phenomena that may ultimately require greater consideration in future assessments as the effect would be to increase the slope of the size-dependent relative fecundity relationship. Additional benefits to the population of multiple brooding likely also include greater probability of encountering optimal environmental conditions for broods, by widening the time period at which larvae are released (although quantifying such benefits presents new challenges).

For maturity, the previous full assessment for chilipepper rockfish used commercial port sampling and fishery-independent survey data (n=10774 females; n=4830 males) to develop maturity at length curves, for which the majority of these data were collected annually between 1992 and 2004. Based on those results, the previous assessment applied a maturity relationship in which 50% of females matured at a length of 25.7 cm. Additional data on female maturity from fishery-independent hook-and-line collections which occurred between August and March 2009 to 2015 (see Beyer et al. 2015 for methods) were available for this assessment (n=1792). Maturity status was assigned by gross macroscopic evaluation of gonads (1=immature, 2=early developing, 3=developing, 4=fertilized eggs, 5=eyed-larvae, 6=spent, 7=recovering; stages 2-7 generally considered mature [see below]). The same logistic equation used in the 2007 assessment was revisited using these new data, and regional differences were explored between females collected from Bodega Bay to Pt. Conception (Central CA; n=936) and those collected south of Point Conception in the Southern California Bight (Southern CA; n=856), although those were not included in the model.

When regions were combined for all available months (Aug to Mar) in the new dataset, 50% of females were estimated mature at 23.5 cm and 95% were mature by 28.6 cm. Separated by region, L_{50} and L_{95} were slightly higher (3 and 2 cm, respectively) in Central compared to

Southern CA. Estimates obtained by temporally restricting samples to the period of peak ovarian development before peak parturition (September to January), when assignment of maturity based on macroscopic evaluation is most accurate, resulted in small a decrease (0.5 cm) in the length of 50% maturity. A subset of ovarian tissue samples collected beginning in August 2013 was processed histologically (n=250) to inform macroscopic assignments of maturity, detect abortive maturation (mass resorption of developing oocytes), and determine if secondary broods (see fecundity discussion) may be identified at early or later stages than possible macroscopically. This analysis is ongoing; however, sections from all stage 2 ovaries (early developing; n=30) collected during this period have been examined and have suggested some interesting results. Specifically, for females collected in September and October (n=17), all ovaries of this stage showed normal development for the current reproductive season. However, in females collected in November and December (n=13), when the vast majority of mature females have vitellogenic (stage 3) or eyed larvae (stage 4), abortive maturation was found to be occurring in 92% (n=12) of the fish identified macroscopically as stage 2 (pre-vitellogenisis), indicating these females were likely incapable of successfully producing a brood of larvae in the current season. To evaluate how sensitive maturity estimates were to this anomaly, using the temporally restricted subsamples, females with stage 1 ovaries were considered immature, as were those with stage 2 ovaries from November – January. The result was a negligible decrease in the combined and Southern CA L_{50} estimates, and a counter-intuitive increase in the Central CA L_{50}. The most substantive change was an increase in L_{95} estimates for all areas.

These results reflect ongoing analyses, and results related to the potential impact of abortive maturation in smaller, younger fish were not explicitly incorporated into the revised maturity curve. Instead, considering the minor changes in L_{50} estimates in sensitivity analyses, the historic data were combined with the recent data (from all regions) in order to update maturity estimates. Females with stage 1 ovaries were considered immature; the rest were considered mature. The L_{50} and L_{95} were 24.4 and 35.2 cm for females (Fig. 2), corresponding to a slope of -0.27. It is unknown if the decrease in female L_{50} between this and the value used in the previous assessment (25.7 cm) is due to increased sample size or reflects changes in growth. However, given an increased awareness and appreciation for the potential biases in macroscopic maturity evaluations outside of the reproductive season, or within the reproductive season for what might in fact be functionally immature fishes (Lefebvre and Field 2015), we intend to continue to evaluate temporal and spatial patterns in observed and functional maturity to better inform future assessments.

Natural Mortality

Based on model estimates and model profiles of alternative natural mortality rates conducted prior to and during the stock assessment review, M was fixed at 0.16 for females, and 0.202 for males. These values are unchanged in the stock assessment update.

Aging Precision

In the 2007 model, the precision of the age determination process was measured by both comparing the independent readings of two age readers of samples collected in 2004 (n=95), as well as comparing independent readings by the same reader (n=97), as reported in the 1998 assessment). Since that time, additional readers (particularly Beyer) have done the majority of the aging, primarily of the Combined trawl survey and triennial trawl survey age structures (N ~ 10,000), including an additional 993 within reader comparisons and 590 between reader comparisons. These data were input into the aging error analysis software developed by Punt et al. (2008) and subsequently adapted by J. Thorson. The results indicated a greater degree of aging error than used in the 2007 assessment (Figure 3), including a slight bias towards underestimating age between the primary reader and others, and a greater standard deviation around age estimates (from 0.1 to age 1-2 fish to 1.8 for age 15 fish) than estimated for the 2007 assessment. This aging error matrix was used in the updated model.

Regulatory History

The Rockfish Conservation Area closures to commercial fishing, and corresponding constraints on recreational fishing to exclude deeper waters (particularly in central California) have dramatically reduced fishing opportunities for chilipepper rockfish since the early 2000s. Landings (or retention) are permitted in all existing fishing activities. For bottom trawl fishing trip limits have recently been constrained to approximately 5000 lbs per trip (these numbers may vary slightly over time and space), primarily as bocaccio rockfish (an overfished species) that co-occurs with chilipepper. Trawl landings of chilipepper tend to be greatest south of 40º10' during periods in which the seaward line of the RCA is set at 150 fm, although there are occasional catches of chilipepper shoreward of the RCA as well. As most of the chilipepper biomass is found in the core area of the RCAs, catches have been far lower than OFLs, generally less than 20% since the mid-2000s (Table 1), and the likelihood of catches increasing substantially in the near term is likely to be fairly low.

D. DATA

Commercial Fisheries Landings

Chilipepper have historically been one of the most important rockfish species in California fisheries. Commercial landings from 1978 to the present were obtained directly from the California Cooperative Survey (CALCOM) database using expansion procedures from sampling commercial market categories. The minor discrepancies between the 2007 and recent catch estimates (for the 1981-2006 period) amount to a very negligible difference of less than 400 tons (48,902 tons in the 2007 model, 49,268 tons in this model).

For historical landings prior to 1978, the 2007 assessment included landings estimates based on an assessment-specific estimation method for partitioning out the fraction of total rockfish catches in California waters that was likely to be chilipepper, based on the species composition of "rockfish" catch from the more recent era. Following the 2007 assessment, a major effort to comprehensively estimate the species composition of the historical "rockfish" catch in both commercial and recreational fisheries was undertaken (Ralston et al. 2010). Those estimates are now used in this update assessment. Table 2 and Figure 4-5 present the catch estimates from the 2007 assessment and those used in this assessment.

The revised catch reconstruction increased the fraction of total historical California rockfish catch that was estimated to be chilipepper. Between 1892 and 1980, the 2007 model were 80,790 metric tons, while total landings based on the revised catch estimates were 95,383 metric tons over the same period. The vast majority of the difference is from the commercial fishery, primarily an increase in estimated trawl landings during the 1940s in the historical reconstruction, and increased hook and line landings from the 1940s through the 1960s. Revised catch estimates from the Oregon catch reconstruction effort (Karnowski et al. 2011) were also used to replace the estimates for the Oregon catch used in the 2007 assessment; these too estimated slightly higher historical landings, although total Oregon catches still represent a very small fraction of both historical and recent coastwide catches.

Landings in the 2007-2014 period are based entirely on NWFSC total mortality reports (inclusive of landed catch and discards), reported by fishery in Table 3 of most reports (e.g., Bellman et al. 2010, Somers et al. 2014). CalCOM estimates of landed catch in California are highly comparable, but not inclusive of discards. Most landings in the last ten years have come from the trawl fishery, for which total catches have increased, from 125 tons in 2007 (consistent with low catches in 2004-2006) to a high of nearly 400 tons in 2013 (dropping slightly to 325 tons in 2014). In most years, 97 to 99% of the total catch is from trawl fisheries, with trace landings in hook and line fisheries (0 to just over 1 ton) and recreational fisheries (2 to 8 tons).

Commercial Discards

Total mortality reports produced by the Northwest Fisheries Science Center suggest that over the past 6-7 years, discards have accounted for approximately 20% of the total catch of chilipepper rockfish, most of which are from the commercial trawl fishery. This presumably reflects a mixture of size-based and regulatory discards.

Recreational Fishery Landings

The historical (pre-1980) catches of chilipepper rockfish in recreational fisheries in California were also revised as part of the California catch reconstruction project, which resulted in a modest increase in those catches. Additionally, a minor error in the interpolation of estimated catches between 1990 and 1993 (for which RecFIN catch estimates are not available) was corrected, resulting in a minor change in the catch estimates for those years. Total recreational catch estimates for the 2006-2014 period were taken from NWFSC Total Mortality reports, while length composition data were downloaded from the RecFIN website for the 2006-2012 period, and provided from CDFW for the years 2013-2014. Virtually all length observations since the early 2000s have been from southern California recreational fisheries, which are concentrated in shallower depths since the early 2000s as a result of management measures.

Commercial age and length composition data

Age determination of age structures collected from commercial port sampling efforts was conducted throughout 2013 and 2014, for structures collected from 2006 to the present, although sample sizes were low. Those data were the basis for age composition data for the trawl fishery; age structures were not available from sampling efforts for other fisheries. Length composition data for the trawl fishery were also updated, and there were very limited length composition data for hook and line fisheries (small sample sizes for 2007, 2008 only).

Recreational CPUE time series

The central California recreational index from the 2007 model was unchanged, although improvements in the spatial resolution of the data, and on the corresponding habitat information, should provide the means to revisit and improve on this index in the next full assessment. Moreover, an index of relative abundance could likely be developed from CDFW onboard observer data collected in southern (and central) California waters since 1999.

Triennial Trawl Survey

The triennial trawl survey index was unchanged from the 2007 assessment, but should be revisited in the next full stock assessment. In recent years, many assessment authors have also chosen to split the triennial survey index into two time periods, however this was not done in 2007 and is considered to be outside of the terms of reference for an update. However, all available otoliths from the survey (1983, 1992, 1998 and 2001) were aged (N ~1900) to support this update and incorporated as traditional age composition data. Otoliths from other years of this survey (e.g., 1980, 1986, 1989 and 1995) were surface-aged historically but the structures have not been able to be relocated from either the NWFSC or AFSC. For consistency with how the combined age and length composition data were treated in other fisheries, the length composition data from this survey were downweighted (lambda 0.1) relative to the age composition data (lambda 1).

Northwest Center Trawl Survey

All otoliths from the 2003-2014 NWFSC Combined Shelf/Slope bottom trawl survey were aged at the SWFSC (N~ 8013) and the age data were provided to the NWFSC in order to do age composition expansions. In the 2007 assessment, age data were only available for one year (2004) for this survey. Haul specific CPUE data from 2003 to 2014, with associated expanded length and age frequency compositions, were provided by Beth Horness (NWFSC), as were estimates of abundance based on swept area methods. The most recent standard Delta GLM, developed by the NWFSC, was used to arrive at annual abundance indices, which were treated as relative (rather than absolute) abundance in the model, as they were in 2007. Stratification was comparable, but not identical to that used in 2007, as the addition of a strata boundary at 34.5 N (Point Conception) was strongly recommended by the NWFSC to accommodate differing sampling densities north and south of that feature. All other boundaries (32° N as the southern boundary, 36° N, 40° N and 43° N as the northern boundary; with depth stratified between 55 and 150 meters, and 150 to 400 meters) were as used in the 2007 GLMM for the NWFSC trawl survey data. The stratification is shown graphically in Figure 6, and the frequency of positive tows and of tow values by depth and latitude (total, and by year) are shown in Figures 7-8, while maps of catch rates spatially are shown as Figures 9-12. The area swept biomass estimates by year and latitudinal strata (and including the percentage of positive tows by year and latitudinal strata) are reported in Table 4.

Model selection criteria indicated that a lognormal (rather than Gamma) distribution provided the best fit to the data, and corresponded to a lower average CV (Figure 13), the model was run with 100,000 MCMC iterations and diagnostics did not indicate convergence problems. A comparison of the 2007 index (4 years) and the most recent index (12 years) using the 2007 software could not be developed as the index in the 2007 assessment was directly provided by T. Helser at the NWFSC in the 2007 round of stock assessments. However, a comparison of the 2007 index and this (2015) index is shown (Figure 14). The indices are clearly quite different, however the area swept indices (also shown) are far more consistent with the 2015 GLMM index.

Juvenile rockfish survey

The Fishery Ecology Division of the Southwest Fishery Science Center has conducted a standardized midwater trawl survey in central California waters during May-June aboard the NOAA R/V David Starr Jordan every year since 1983 (Ralston et al. 2013). The primary purpose of the survey is to estimate the abundance of pelagic juvenile rockfishes (*Sebastes* spp.) and to develop indices of year-class strength for use in groundfish stock assessments on the U. S. west coast. Response to concerns regarding the appropriate spatial scale of data to inform such indices (a combination of a PWCC/NWFSC surveys and an expanded spatial and temporal scope of the SWFSC survey), have led to coastwide coverage in most years since 2001. This survey has encountered substantial interannual variability in the abundance of the ten species that are routinely indexed, as well as high apparent synchrony in abundance among the ten most frequently encountered species (Ralston et al. 2013, Ralston and Stewart 2013).

The 2007 assessment included a combined juvenile abundance index from 2001-2006 that used both SWFSC and NWFSC/PWCC survey data, and estimated relative abundance of age-0 rockfish by integrating the results of both surveys in an ANOVA model with year, latitude, period, and depth as fixed effects, and vessels as random effects. This update continues that usage, with the documentation of the data, methods, results and diagnostics for the indices available in Ralston et al. (Appendix 2). Importantly, the variance in the 2007 index was unrealistically tight, and constrained estimates of year class strength even in the face of conflicting age composition data in early runs of the model. The variance in the 2015 indices is considerably greater (CVs of approximately 0.5), leading to far more realistic behavior in the model. Also notable is the extremely high magnitude of the 2013 year class predicted by the juvenile index, roughly two orders of magnitude greater than the average index value for the preceding ten years, followed by a high value in 2014 of roughly one order of magnitude greater than those in the 2001-2012 period (Figure 15). This reflects the very high abundance of juvenile rockfish observed in 2013, such that in the core area (sampled consistently since 1983) total juvenile rockfish abundance was the highest observed throughout the entire time series. The extent to which the predicted value may truly be accurate is unclear, as consideration of density dependent processes suggests that a power coefficient to transform the index could lead to improved performance. This was not done in the 2007 assessment due to the short duration of the time series and other factors; as such this was not explored in this assessment to be consistent with the terms of reference. Yet this remains an uncertainty that should be explored more robustly in future research and assessments.

E. MODEL

Description of the 2007 Assessment Model

The 2007 stock assessment was developed in Stock Synthesis II (SS2), version 2.00c, an age and size structured statistical model that was the standard for most West Coast groundfish assessments in 2007. The model included a revised (at that time) catch reconstruction, with the catch history extended back to 1892. Length and age composition data were available for commercial trawl, hook and line and setnet fleets for a mix of years (in which the fleets were operational) between 1978 and 2006, although data were not available in some years and were considered unreliable in others. The 2007 model also included relative abundance indices developed using commercial trawl logbook data (1980-1996), CPFV observer data (1987-1998), the triennial trawl survey (1980-2004) and the NWFSC combined shelf and slope bottom trawl survey (2003-2006). Juvenile survey indices were included based on a new coastwide index for the last six years of the model (2001-2006). Steepness in the 2007 model was fixed at 0.57, natural mortality fixed at 0.16 for females, 0.20 for males, and selectivity curves were based on logistic curves for the trawl fishery, the hook and line fishery, and the two surveys, while the double-normal selectivity curve was used for setnet and recreational fisheries. Time varying growth was estimated internally in the model, implemented with time block offsets for the growth coefficient, K, using time period blocks that were informed by major shifts in the signal for the Pacific Decadal Oscillation.

The 2007 base model had equal emphasis factors (lambdas=1.0) for most likelihood components, with the exception that lambdas were set at 0.1 for length composition data in fisheries and surveys for which (traditional) age composition data were available (trawl, hook and line, setnet fisheries, as well as the NWFSC Combined survey). This downweighting was acknowledged to be an ad-hoc approach, to lessen the possible effects of double-use of data from the same fish. It was recognized at the time that a more appropriate approach would be to use conditional age-at-length compositions, which would also facilitate the estimation of growth (including time-varying growth) internally. This was outside of the terms of reference for an assessment update, but remains a priority for future assessment and research efforts.

Prior Probabilities

In the 2007 model, a prior probability for steepness was made available to assessment authors from an updated meta-analysis based on Dorn (2002). The prior developed for chilipepper rockfish in 2007 had a mean value of 0.573 with a CV of 0.183. By contrast, the prior values of steepness available for the 2015 assessment cycle were considerably higher, 0.773 with a CV of 0.147. In the 2007 model, steepness was fixed at the 2007 point estimate, and no other prior probabilities were used in the model, although the standard deviation of the prior probability was used to bracket uncertainty in the decision table. Based on the results of a likelihood profile on steepness following the updating of data and time series in this model, the 2007 point estimate for steepness was left unchanged in the base model.

F. BASE MODEL SELECTION AND EVALUATION

Comparison with the last assessment

This section sequentially tracks the changes in model results between the 2007 assessment and the final version of this assessment update.

Update from SS2 to SS3

The first change was to move to a newer version of Stock Synthesis. The 2007 model used SS2 Version 2.00c; the starter, data, control and forecast file were altered to conform to the format required to run SS3 Version 3.24O, without changing the fundamental model structure of the last assessment. The first improvement was in the time required to complete the run, which declined from nearly 10 minutes in SS2 to 3-4 minutes in SS3. However, in comparing the resulting time series and likelihood estimates between the two base model runs, it was clear that some non-trivial changes in the model parameter estimates and resulting outputs had taken place. First, the total likelihood was greater (by about 20 points) in the SS3 model, inferring that some means by which age compositional data (which accounted for most of the increase) is fit between the two model versions (Table 4). Second, the starting unfished spawning biomass was higher in the SS3 model than in the SS2 model (33,395 metric tons in SS2; 37,751 metric tons in SS3; Figure 16a), resulting in a noticeably more pessimistic perception of stock status (from 71% to 57% in 2015, although the 2007 depletion point estimates are highly comparable, at 71% versus 69%).

Through the comparison of parameter estimates among the two models, it became clear that the primary driver of these disparities was the time-varying growth function. Specifically, the SS3 version of the model estimated a smaller growth coefficient (K) offset in the 1970-1979 period than the SS2 model had (effective K's were 0.32 in SS2 and 0.23 in SS3 respectively). Both of these were higher than the "baseline" K initially estimated in the 2007 model (0.1945), but the effective K estimate in the 2007 model was by far the highest growth rate in the time series for that model, while the re-estimated parameter in the SS3 version of that model was within the mean of the range of values estimated for later (more data informed) periods (range 0.20 to 0.26 for the various 1980-2006 time periods).

The best interpretation for this is that the 2007 model was estimating a higher growth rate during a time period in which compositional data (e.g., the data that would be informative with respect to an actual growth rate) were minimal, in order to alias higher productivity during the period in which landings were increasing substantially in the 1970s. In fact, the 2007 model estimated an increase in SSB between 1970 and 1979 of nearly 6000 metric tons, while in the SS3 version the stock was declining modestly (by approximately 900 metric tons) during the same period. The suspicion that the estimation of the time-varying growth parameters was the key factor in the differences between models was confirmed by running both the SS2 and SS3 versions of the 2007 model without the time varying growth, for which population trajectories and associated parameter estimates were nominally identical (Figure 16b). Although the slight differences in overall likelihood remained (Table 5), these differences were assumed to be a consequence of internal changes in the Synthesis framework that did not warrant additional concern with respect to this update.

Updates to Fishery Dependent Data

Following conversion to SS3, the 2007 model in SS3 was extended through 2014, revised data and time series were sequentially added, the differences in model results explored and discussed, in order to link the 2007 model to the base model in this update. The first revision was to the historical catch history. As mentioned earlier, California historical catches (both commercial and recreational) were updated from the estimates developed in the 2007 assessment to those developed by Ralston et al. (2010). Figures 17a-b show the time series of spawning biomass, depletion, exploitation rate and recruitment for the model in SS3 run through 2007 with the 2007 and the updated 2015 catch estimates, respectively (key model outputs and likelihood estimates by component for all substantive changes are also tracked in Table 5). The slightly greater catches in the 2015 model result in no appreciable change to the starting spawner biomass, however they did alter the biomass trajectory, with a greater dip in the spawning biomass and relative depletion estimates from the 1940s through the mid-1960s, as well as (of course) the (1-SPR) relative fishing rate (Figure 18a), which is now estimated to have been greater in the time period during which catches were greater. From the mid-1960s through the present, the biomass trajectory and recruitment estimates are essentially unchanged between the two model versions.

Following the revisions of the catch history and the updating of catches from 2006 through 2014, new commercial and recreational compositional data were added. Commercial data included age composition data from 2007-2014 (trawl fishery only), length composition data from the same time period in the trawl fishery, and a very small number of samples from the hook and line fishery, and recreational length composition data for the entire 2006-2014 period (Figures 19-20). The addition of the commercial age and length compositional data had very minor influence on the model result; the model trajectory, depletion, recruitment and relative SPR rate changed only to a trivial extent with the addition of those data (there was a very slightly more optimistic perception of 2015 stock status, from 57 to 59%). However, the addition of the recreational length composition had what seemed to be an unrealistically strong effect on model results, particularly with respect to a shift to a considerably more pessimistic perspective on depletion in the early 2000s and a series of extremely high year classes from 2009 through 2014. This was determined to be primarily a consequence of the depth and area closures implemented to constrain recreational fishing, particularly in Central California, where historically recreational catches were the greatest. From 2002 onward, only a small fraction of the length compositional data came from north of Point Conception, where depth closures have ranged from 20 to 40 fathoms in most years and areas since 2002. However, chilipepper have continued to be taken in the waters South of Point Conception during that period, where depth restrictions are also in place but less severe than those in Central California (typically 40-50 fathoms). As a consequence of the ontogenetic shift in chilipepper to deeper water with size and age (described in detail in the 2007 assessment), the shift in both the latitudinal and depth-based effort distribution has altered the selectivity of the recreational fishery.

Thus, a selectivity offset for the 2003-2014 period was incorporated into the model, which resulted in a strongly dome-shaped selectivity curve for the 2003-2014 period, shifted far to the left of the curve estimated for the pre-2003 data. This addition resulted in an improvement of approximately 130 likelihood units (the addition of the recreational length data had increased the total likelihood by 183 likelihood points), with model trajectories and depletion very comparable to the models that did not include the updated recreational fishery length composition data. Key differences included a slight increase in the unfished spawning biomass and recruitment levels, slightly more depleted stock status in the late 1990s, and signs of strong recruitment in the 2009-2014 period. Future assessments should consider separate northern and southern recreational fisheries, as well as greater exploration of time varying selectivity for these fisheries. With the selectivity time block, fits to the recent recreational length composition data improved substantially, the extreme high recruitments indicated without the selectivity adjustment were reduced to more plausible levels (indeed there is considerable evidence for strong recruitment during this period, as shall be seen shortly), and the overall patterns in the spawning biomass and depletion trends in the post-2000 period became more aligned with the estimated trends prior to the addition of the recreational composition data (albeit with a slightly more pessimistic trend). As the addition of selectivity time blocks when there is a strong basis for a shift in selectivity is consistent with the terms of reference for updated stock assessments, this selectivity offset was maintained in the base update model.

Updates to Fishery Independent Data

The next set of data to be added to the update included the 2003-2014 Northwest Fisheries Science Center combined trawl survey index and associated age and length compositional data (Figures 21-22). The combination of the trawl survey index and compositional data resulted in very little change to the overall spawning biomass and depletion trajectories, but led to a considerably more optimistic estimate of recent (post-2000) stock status, largely in response to inflation of the relative size of the 1999 year class which dominated survey (and other) catches over most of the survey time period. The estimated recruitment deviation was already the largest in the time series for the stock, but increased even more with the additional survey data (note that this inflation is perceptible in the recruitment and recruitment deviation figures, but in the latter the deviation estimates are partially masked by the legend). Moreover, the strong year classes suggested by the recreational compositional data for recent years became more apparent from the survey age and length composition data, with substantial increases in the size of 2009, 2010, and 2013 year classes (this was at least partially offset by declines in the estimated magnitude of 2011 and 2012 year classes). Although fits to the survey abundance time series were not outstanding, they are consistent with those observed in other fishery-independent and fishery dependent time series for this stock, and the stock trajectory does follow the general trends in the survey index (see model results section). Fits to both the age and length compositional data are also reasonable.

The addition of four years of triennial trawl survey age compositional data (1983, 1992, 1998 and 2001) did lead to some modest, but very perceptible changes to the stock trajectory, with a higher absolute spawning biomass historically, modest declines in the magnitude of several year classes in the 1970s, and lower relative abundance over the past 15 years. It is very plausible that this is related to some of the issues related to selectivity in this survey, which was fixed in the 2007 assessment due to model instability when freely estimated. Indeed, when freely estimated in this model, the Hessian was not positive definite and the poor model performance continued. The poor spatial overlap of the triennial trawl survey with the core areas of this stock (Southern and Central California) is very likely to be among the key contributing factors, as is the simple fact that this semipelagic species may not be well represented in terms of abundance by bottom trawl surveys.

Finally, the addition of the 2001-2014 pelagic young-of-the-year (YOY) index should be viewed in the context of the index it replaced. The 2001-2006 index used in the 2007 model had very (unrealistically) tight coefficients of variation (CV's), an unexpected consequence of how the indices were modeled following a shift from a delta-GLM approach to an ANOVA approach. The indices for 2001-2014 developed for the 2015 assessment cycle (Ralston et al., unpublished data) had considerably more "realistic" CVs (averaging approximately 0.5). As a consequence of both that fact and the more informative age compositional data from the survey, there were nontrivial shifts in the relative strength of several year classes in the early 2000s that were now better informed by survey compositional data. As the recruitment index was dominated by an extremely high (roughly two orders of magnitude over the previous 10 years) recruitment in 2013, and a very strong recruitment (only an order of magnitude greater than the previous 10 years) in 2014, the recruitment index had the most influence on those two years, inflating the already strong 2013 recruitment and informing a very strong 2014 recruitment as well.

Note that the 2013 recruitment was also informed by a large number of age 1 fish in the combined trawl survey. Moreover, as the base model from 2007 did not include age 0 fish in the age composition matrix, the large number of age 0 fish actually observed in 2013 (which help validate the magnitude of the 2013 year class in the juvenile survey) could not be included. A sensitivity analysis in which the structure of the age compositional data was altered to include age 0 fish (presumed to be outside of the terms of reference for strict assessment updates) was developed and demonstrated that the magnitude of the 2013 year class was indeed inflated when the age 0 fish from 2013 were included in the model, even when the pelagic juvenile index was excluded (Figures 23-24). However, the combined trawl survey data had only a modest number of age 0 fish in 2014, thus it remains to be seen whether the high magnitude of the 2014 year class predicted by the juvenile survey will be manifest. Regardless of that particular uncertainty, it is very clear that the relatively modest recruitment that followed the 1999 year class has been more than offset by a suite of 3-4 very strong year classes since 2009.

Updates of Life History Data

Continuing with the model that included all updated commercial and recreational compositional data and indices, the life history data were updated next (Figures 25-26). The update of the fecundity relationship had the predictable effect of changing the units of spawning biomass (note that the units are actually billions of larvae, not millions of eggs), and estimated a very slightly more pessimistic view of stock status (as larger, older fish are less abundant in response to fishing but more productive than their smaller counterparts). The updating of the maturity relationship had very little effect, but resulted in a (very) slightly more optimistic estimate of stock status. The updating of the aging error matrix actually had a fairly substantial impact on model behavior, with an increase in the degree of variability in the recruitment deviation values that is likely a consequence of the recognition of a greater extent of aging error than that quantified in the 2007 assessment. This in turn resulted in a more optimistic perception of stock status (Figures 25-26).

Finally, consideration of how to continue or alter the time blocks for the time-varying growth took some considerable effort. First, the existing block from 1999 to 2006 was simply extended to 2014, which led to very trivial changes in the stock relative abundance trajectory and end year status. Given that the 2007 model based the time intervals on major shifts in the Pacific Decadal Oscillation (PDO), as an indicator of productivity in the California Current, the addition of both one and two more time blocks that represented major shifts in the mean values of the PDO (generally negative from 1999-2003, positive from 2003-2008, negative from 2009-2014) was also explored (Figure 27-28). However, the consequences of these extensions were counterintuitive, with the effective estimated growth coefficient (K) dropping to what were considered to be unrealistically low levels (0.11-0.12) from a baseline level of approximately 0.2. In the model, the 2003-2014 period in the model was associated with large numbers of age composition data from surveys in which age 1-3 fish were highly abundant, such data were not available in earlier years, and this seemed to be a major contributing factor to this result. Additionally, the survey data included a high fraction of fish were from south of Point Conception, where age data were previously all but fully unavailable for either surveys or fisheries and where growth and maturity patterns appear to differ. For these reasons, the 2007 model structure was maintained with 5 time blocks, such that the last extended from 1999-2014 rather than 1999-2006.

A final determination for the base update model was how to treat steepness. In the 2007 model, steepness (h) was fixed at the mean of the steepness prior updated from Dorn (2002), a value of 0.57 with a standard deviation of 0.18. However, the prior available for the 2015 assessment cycle (0.77) was considerably higher. While the terms of reference for assessment updates states that it is acceptable to use updated parameter priors, it does not recommend updating priors over maintaining previous values. Interestingly, although the 2007 model likelihood profile indicated a slightly better fit at high steepness values (although the data were poorly informative at values of steepness greater than about 0.5), the updated 2015 model demonstrated a better fit at lower steepness values, and when steepness was estimated, using either prior, the resulting point estimate was approximately 0.40 (Figures 29-30). Consequently the STAT decided to maintain steepness at the point estimate that was adopted in the 2007 assessment, of 0.57. Figures 29-31 show model estimated larval output, depletion, recruitment and recruitment deviation values for the base, higher and lower steepness values used in the 2007 model, as well as when the 2007 prior was used to estimate steepness in the model.

G. POINT BY POINT RESPONSE TO STAR PANEL RECOMMENDATIONS

This section is not relevant to a stock assessment update. However, we note that most of the 2007 STAR Panel recommendations that could be accommodated within the terms of reference for an assessment update have been done. Specifically, this assessment uses the results of comprehensive catch reconstructions for California and Oregon, and uses age estimates developed for all available fisheries-independent surveys (4 years of triennial trawl survey age composition data, 11 additional years of NWFSC bottom trawl survey age composition data).

H. BASE MODEL RESULTS

The 2015 update of the 2007 stock assessment was developed in Stock Synthesis 3 (SS3), version V3.24O, and as described earlier, maintained the same structure as the 2007 model, with updates to select life history information, catch histories, fishery-independent surveys, and age and length composition data from commercial and recreational fisheries. Time varying growth was estimated internally in the model, implemented with a time-varying growth coefficient, K, using five time period blocks that were informed by major shifts in the signal for the Pacific Decadal Oscillation. As in the 2007 model, the 2015 base model had equal emphasis factors (lambdas=1.0) for most likelihood components, with the exception that lambdas were set at 0.1 for length composition data in fisheries and surveys for which (traditional) age composition data were available (trawl, hook and line, setnet fisheries, as well as the NWFSC Combined survey). For the final base model, the total number of parameters estimated in this model was 88, including R_0, time-varying growth (K offsets, 5), parameters for logistic selectivity curves for trawl and hook and line fisheries and the two trawl surveys (8), parameters for the double-normal selectivity curves for the setnet fishery, recreational fishery, and recreational CPUE index (18), parameters for double-normal age selectivity for the recreational CPUE index (6), and recruitment deviation values for the years 1965-2006 (50). All were also estimated in the 2007 model, except of course for the 2007-2014 recruitment deviation estimates. Table 6 provides the estimates for all of these parameters, and compares each to the values estimated in the 2007 model.

As in the 2007 model, convergence required that the selectivity for the triennial trawl survey as well as the age selectivity for the recreational CPUE index be fixed at their estimated values. Also as in the last model, the likelihood surface was found to be quite irregular, model results and total likelihood values often varied slightly when the model was re-run, although as in 2007, the effect on the core trends and estimated output values was typically negligible. The life history relationships that changed between the 2007 and the 2015 base model are shown in Figures 32 a-d, total catches and relative exploitation rates are shown in Figures 33a-b, and fits to age and length compositional data (including only those datasets in which new data were included in the 2015 model) are shown in Figures 34-51. The fits to survey indices are shown in Figures 52-53. Age and length selectivity curves are shown for all fisheries in Figure 54, and by fishery in Figures 55-56. The base model estimates of total larval production, summary biomass, recruitment, depletion, spawning biomass per recruit (SPR), total catch, and fishing mortality rate are provided in Table 7, and in figures 57-63.

I. EVALUATION OF UNCERTAINTY

Sensitivity Analysis

The sequential addition of new datasets and life history information provide the basis for most sensitivity considerations in this update. Although steepness remains poorly resolved in this model, the likelihood profile suggests a considerably lower value than was suggested by profiles in the 2007 assessment, for which the model preferred a high steepness value (but the profile was quite uninformative between values of approximately 0.6 and 1). The likelihood in this model remains fairly uninformative, with a change of less than 2 likelihood units across the range of steepness values (Figure 64 a-b), however the best value seemed to be approximately 0.4. Not surprisingly, the different sources of data were in conflict with respect to fitting better with a lower or higher steepness; length data and recruitment penalties had an improved fit with very high steepness values, while index and age data had an improved fit with lower steepness values.

The poor fit to the NWFSC bottom trawl survey index was explored further, and sensitivity tests suggested that a better fitting selectivity curve would be dome-shaped rather than asymptotic (Figures 65 a-d). As the end result changed little with this change (Table 7), and as changes in the selectivity functions were considered to be outside of the bounds of an assessment update (a bit of a Pandora's box for this model in particular), this change was not made in the base model.

Retrospective analysis

A retrospective analysis was conducted by sequentially removing the most recent two years of data, such that models included data through 2012 and 2009 only (Figure 66-67). The two year retrospective is slightly more pessimistic with respect to stock status, while the five year retrospective is somewhat more optimistic. In the STAT's view, this is a consequence of the very large year classes estimated in recent years, as played out in the recruitment penalty (which attempts to "sum" recruitment deviation values to 0 over the time series). Without the 2013 and 2014 year classes, the magnitude of the 2009 and 2010 year classes is greater and relatively little else is changed (meaning that historical recruitments are all very slightly reduced). Without the 2009-2014 year classes (retro-5), the year classes in the mid-2000s are all slightly higher (although still relatively small, with negative recruitment deviation estimates) and all historical recruitment deviation estimates are slightly higher, leading to a more optimistic perception of stock status. This illustrates the counterintuitive consequence of strong, recent recruitment in assessment models, such that to balance recent strong year classes which have typically not yet matured and become reproductively active) in populations with very high recruitment variability (e.g., sigma R ~ 1, as it is for chilipepper), the model must "balance" earlier recruitment deviations and typically the entire depletion time series is scaled down modestly to substantially.

Technical Challenges

During the 2007 STAR Panel review, the length composition data were down-weighted when associated age-composition data were available, however the approach (a lambda of 0.1 for length data where age data also exist, and 1 for the associated age data) was acknowledged to be ad-hoc and lacking a solid theoretical basis. A more appropriate approach is to use conditional age-at-length compositions, which was attempted in early runs but led to a suite of problems in model tuning. The estimated growth curves had kinks that could probably be eliminated by reducing the lower bound of the smallest length bin, which would also help the fit to the two fisheries independent trawl surveys, both of which sample high numbers of fish smaller than 16 cm. Ideally, this would negate the need to fix the parameters for the triennial survey selectivity, which was necessary to invert the Hessian matrix, and would better utilize survey data.

A closely related problem is that selectivity functions for the fishery independent bottom trawl surveys should be revisited (as discussed above). Selectivity for commercial and recreational fisheries should also be carefully considered in future models. The results from the convergence tests with randomly jittered starting parameter values continue to indicate that the likelihood surface is very irregular. However, as in the 2007 model, biomass trajectories and other critical results do not appear to be sensitive to these differences. Although there is a clear progression from shallow to deeper water with age and size, the application of a combined age- and length-based selectivity curve for the recreational CPFV data developed for the 2007 model is somewhat non-traditional and would benefit by either more detailed investigation or an alternative selectivity configuration. The tension between index and length data (which are better fit with high steepness values) and age data (better fit with low steepness values), needs to be better understood. Finally, a more comprehensive evaluation of time varying growth for this species, ideally using conditional age at length data rather than traditional age composition data, should be explored, including alternatives to the assumption that the growth coefficient (K) is the appropriate parameter to estimate as time varying. Spatial differences in growth and other life history characteristics should also be explored.

K. REFERENCE POINTS

Reference points, including estimates of yield under target SPR and relative biomass target levels, are reported in Table 8. The model estimated an unfished larval production (spawning biomass) (SSB_0) of 7.05 billion larvae (labeled as eggs in figures), an unfished summary biomass of 54,578 tons, and a 2015 larval output of 4.5 billion larvae, which results in a relative depletion estimate of 64.0% (of the unfished spawning output). The summary biomass for 2015 was 36,797 tons, corresponding to 67.4% of the estimated unfished summary biomass. The depletion level at its lowest point (1999) was estimated to be 20.9% of the unfished larval output. Results of the updated base model suggest that the current perception of stock status at the time of the last assessment (e.g., 2006-2007), as well as currently, is of a population significantly above target biomass levels. The 1999 year class dominated both fishery and survey catches throughout most of the 2000s, as the following ten years (until 2009) were associated with low recruitment (all but one recruitment deviation parameter was negative). Thus, the stock declined slightly following a peak around 2005-2006, although a series of strong recruitments in 2009-2010 have shifted the population trajectory again to increased abundance, and two more strong year classes in 2013-2014 are poised to send the stock and larval production to an even greater increased level of abundance.

As seen in Table 8, as well as in the yield curve in Figure 58a, the estimates of potential yield are fairly flat between approximately 30 and 50% of the unfished spawning output, and this is consistent with the estimates of yield based on the spawning biomass reference point proxy (40% of unfished; associated yield is 2136 metric tons), the SPR target reference point (0.5, yield is 2115) and the estimated MSY (associated with an SPR of 0.44 and depletion of 0.34; corresponding yield is only 52 tons greater than that at SPR=0.5, estimated at 2165). These values are highly consistent with the estimates from the 2007 assessment, which were 2155, 2099 and 2165 for the SB40%, SPR0.50 and MSY based yield estimates respectively.

L. HARVEST PROJECTIONS AND DECISION TABLE

The decision table follows the 2007 assessment format, with the two alternative states of nature equating to low (steepness set to 0.34) and high (steepness set to 0.81) productivity assumptions.

Catches are based on either the status quo for the “low” catch scenario (average catch over the past 5 years), on the adopted 2015-2016 ACLs and forecast 2017-2026 ACLs for the moderate catch level, and the combined 2015-2016 ACLs and forecast 2017-2026 OFLs for the “high” catch level. As chilipepper is considered a category 1 stock with a P* = 0.45 in recent years (translating to a 4.4% buffer for the ACL to be set below the OFL), the difference between ACL and OFL catch streams is not terribly large. Figures 68-71 show the total biomass, spawning biomass, depletion (with reference 25% and 40% of unfished biomass references), and depletion with a twelve year forecast from 2015 onward. Under the base and high productivity scenarios, none of these catch streams lead to conservation concerns, however under the low productivity scenario (h=0.34), the stock rebuilds to target levels with status quo catches, but declines below the overfished threshold by 2019 with ACL or OFL catches.

M. REGIONAL MANAGEMENT CONSIDERATIONS

The 2007 STAT and STAR Panel concluded that data were insufficient to consider spatial structure in the model, consequently the resource continues to be modeled as a single stock. Ongoing life history studies suggest that growth, maturity and other reproductive parameters (e.g., extent of multiple brooding) may be different in southern areas.

N. RESEARCH AND DATA NEEDS

Although considerable information on the reproductive ecology of this species has been compiled, the possible significance of multiple brood production and the spatial or physical drivers of such factors is highly uncertain and should be explored. Greater exploration of methods for modeling time-varying growth are essential, there remains a need to explore a model that uses conditional age-at-length data and a need to explore other possible drivers of variable growth rates. Continued evaluation of the coastwide juvenile index should be an important element of both future research and future assessments, particularly with respect to the mechanisms that drive such strong variability in cohort strength, and the potential use of a compensatory relationship between pelagic YOY and the population at later ages.

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P. LITERATURE CITED

Bellman, M.A., E. Heery, J. Jannot, and J. Majewski. 2010. Estimated discard and total catch of selected groundfish species in the 2009 U.S. west coast fisheries. West Coast Groundfish Observer Program. National Marine Fisheries Service, NWFSC, 2725 Montlake Blvd E., Seattle, WA 98112.

Beyer, S.G., S. M. Sogard, C.J. Harvey and J.C. Field. 2015. Variability in rockfish (*Sebastes* spp.) fecundity: species contrasts, maternal size effects, and spatial differences. Environmental Biology of Fishes 98:81–100.

Davis, J.C. 1949. Salt water fishing on the Pacific coast. A.S. Barnes and Co. New York.

Dorn, M.W. 2002. Advice on West coast rockfish harvest rates from Bayesian meta-analysis of stock-recruit relationships. North American Journal of Fisheries Management 22: 280-300.

Field, J.C. 2008. Status of the chilipepper rockfish, *Sebastes goodei*, in 2007. In: Status of the Pacific Coast Groundfish Fishery Through 2007, Stock Assessment and Fishery Evaluation: Stock Assessments and Rebuilding Analyses Portland, OR: Pacific Fishery Management Council.

He, X. J.C. Field, S.G. Beyer and S.M. Sogard. 2015. Effects of size-dependent relative fecundity specifications in fishery stock assessments. Fisheries Research 165: 54–62.

Karnowski, M., V.V. Gertseva and A. Stephens. 2011. Historical Reconstruction of Oregon’s Commercial Fisheries Landings. Oregon Department of Fish and Wildlife Informational Reports 2014-02.

Lefebvre, L. and J.C. Field. 2015. Reproductive complexity in a long-lived deepwater fish, Blackgill rockfish *Sebastes melanostomus*. Transactions of the American Fisheries Society 144:383–399.

Love, M.S., M. Yolkavich and L. Thorsteinson. 2002. The rockfishes of the Northeast Pacific. University of California Press: Berkeley.

Punt, A. E., Smith, D. C., KrusicGolub, K., and S. Robertson. 2008. Quantifying age-reading error for use in fisheries stock assessments, with application to species in Australia's southern and eastern scalefish and shark fishery. Canadian Journal of Fisheries and Aquatic Sciences, 65(9), 1991-2005.

Ralston, S. 1999. Trends in standardized catch rate of some rockfishes (*Sebastes* spp.) from the California trawl logbook database. SWFSC Admin. Rep. SC-99-01.40p.

Ralston, S., D. Pearson and J. Reynolds. 1998. Status of the chilipepper rockfish in 1998. In Appendix to Status of the Pacific Coast Groundfish Fishery through 1998 and recommended acceptable biological catches for 1999. Stock Assessment and Fishery Evaluation. Pacific Fishery Management Council, Portland OR.

Ralston, S., and I. Stewart. 2013. Anomalous distributions of pelagic juvenile rockfish on the U.S. West Coast in 2005 and 2006. CalCOFI Reports 54: 155-166.

Ralston, S., D. Pearson, J. Field and M. Key. 2010. Documentation of the California commercial catch reconstruction project. NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-461.

Ralston, S., K.M. Sakuma and J.C. Field. 2013. Interannual Variation in Pelagic Juvenile Rockfish Abundance– Going With the Flow. Fisheries Oceanography 22: 288–308.

Somers, K.A., M. Bellman, J. Jannot, N. Riley and J. McVeigh. 2014. Estimated discard and catch of groundfish species in the 2013 U.S. west coast fisheries. NOAA Fisheries, NWFSC Observer Program, 2725 Montlake Blvd E., Seattle, WA 98112.

Table 1: Management Performance, estimated catches relative to OFL (ABC) and ACL (OY) harvest levels for the 2005-2016 period.

	OFL (ABC prior to 2011, south 40 10 only from 2011 onward)	ACL (OY prior 2011)	Chilipepper contribution to minor shelf rockfish north (OFL), 2011 onward	Total Catch (see Table 3)	Catch as % of combined OFL
2005	2,700	2,000		85	0.03
2006	2,700	2,000		126	0.05
2007	2,700	2,000		137	0.05
2008	2,700	2,000		148	0.05
2009	3,037	2885		318	0.10
2010	2,576	2,447		397	0.15
2011	2,073	1,981	156	331	0.16
2012	1,872	1,789	140.9	307	0.16
2013	1768	1,690	133.1	405	0.23
2014	1722	1,647	129.6	325	0.19
2015	1,703	1,628	*129.6*		
2016	1,694	1,619	*129.6*		

Table 2: Revised historical catch estimates

	California			Oregon		CA and OR
	trawl	hook.line	rec	trawl	hook.line	foreign
1916	28.9	694.8	0.0			
1917	44.8	1104.0	0.0			
1918	52.5	1123.5	0.0			
1919	36.5	722.5	0.0			
1920	37.2	760.7	0.0			
1921	30.7	647.0	0.0			
1922	26.4	598.3	0.0			
1923	28.6	732.4	0.0			
1924	16.4	763.8	0.0			
1925	13.5	864.7	0.0			
1926	40.3	1149.1	0.0			
1927	73.8	943.2	0.0			
1928	94.7	903.9	1.7			
1929	112.0	855.2	3.5			
1930	117.2	973.2	4.2		0.0	
1931	80.5	1079.4	5.6		0.0	
1932	95.6	733.5	6.9		0.0	
1933	146.2	508.4	8.3	0.0		
1934	140.9	553.2	9.7	0.0	0.0	
1935	125.7	617.3	11.1	0.0	0.0	
1936	133.4	422.5	12.2	0.0		
1937	161.5	341.5	16.3	0.0	0.0	
1938	136.4	334.8	15.5	0.0	0.0	
1939	141.2	388.2	13.5		0.1	
1940	111.7	363.6	16.8	0.0	0.1	
1941	86.5	328.0	15.6	0.1	0.1	
1942	22.4	147.1	8.3	0.1	0.0	
1943	233.7	139.8	7.9	0.3	0.1	
1944	878.6	216.3	6.5	1.1	0.1	
1945	1852.8	421.9	8.7	1.9	0.1	
1946	1445.6	298.2	14.9	2.4	0.1	
1947	935.1	364.1	17.2	1.7	0.1	
1948	562.0	405.0	40.7	1.5	0.0	
1949	725.8	353.7	52.7	3.2	0.1	

Table 2 (continued)

	California trawl	hook.line	rec	Oregon trawl	hook.line	CA and OR foreign
1950	963.5	446.1	54.9	3.4	0.1	
1951	1177.1	500.4	55.9	2.2	0.0	
1952	885.5	258.6	62.2	3.1	0.0	
1953	1118.9	248.5	59.8	4.5	0.1	
1954	965.4	311.8	101.0	2.6	0.0	
1955	1508.6	414.0	140.4	11.6	0.0	
1956	1155.9	300.9	162.9	10.5	0.0	
1957	1640.2	335.6	130.3	24.8	0.0	
1958	1450.8	372.0	130.2	13.4	0.0	
1959	1243.7	297.4	93.8	4.2	0.0	
1960	1191.2	424.7	97.3	3.8	0.0	
1961	653.3	346.5	82.5	8.9	0.0	
1962	555.6	377.5	94.7	7.9	0.0	
1963	1142.2	502.6	80.0	8.5	0.0	
1964	913.1	418.9	105.1	17.9	0.0	
1965	986.6	407.5	116.6	7.6	0.0	
1966	1041.0	320.0	183.3	3.4	0.1	985.0
1967	967.8	286.0	193.6	3.0	0.0	1634.0
1968	751.0	193.7	202.4	3.8	0.1	671.0
1969	655.5	43.6	207.6	2.5	0.1	53.0
1970	842.3	40.3	279.4	2.3	0.2	1.0
1971	724.6	50.4	237.9	1.8	0.1	2.0
1972	1051.9	78.5	284.2	1.8	0.3	26.0
1973	1587.4	72.6	362.3	0.8	0.3	907.0
1974	1440.2	110.5	437.5	0.6	0.4	1403.0
1975	1686.5	86.6	398.0	0.5	0.5	734.0
1976	1886.4	123.4	373.0	1.7	0.2	529.0
1977	1867.8	100.7	324.2	0.4	0.3	
1978	1292.9	194.9	313.7	0.1	0.4	
1979	2003.2	230.7	448.1	0.1	0.5	
1980				0.5	0.3	
1981				2.4	0.3	
1982				3.1	0.2	
1983				28.0	0.2	
1984				26.0	0.2	
1985				2.9	0.2	
1986				3.0	0.3	

Table 3: Total mortality estimates for 2004-2014 period

	trawl*	fixed gear	recreational
2004	145	2	6
2005	76	3	6
2006	124.3	0	1.6
2007	125	4	8
2008	145	0	3
2009	314.8	0.6	2.1
2010	394.1	0.2	2.8
2011	325.3	0.7	5.0
2012	298.5	1.2	7.7
2013	397.2	0.9	7.3
2014**	316.9	0.9	6.7

Table 4: Total area swept biomass from NWFSC Trawl Survey (with CV and % positive)

Total Biomass (metric tons) in 55-400 m depth strata

	U.S./ Mexico Border to Point Conception	Point Conception to Cape Mendocino	Cape Mendocino to Cape Blanco	Cape Blanco to U.S./ Canada Border	Total South of Cape Blanco	Total Coastwide
2003	14401	91908	946	3	107256	107259
2004	537	73025	5441	1665	79003	80668
2005	6992	104165	6405	226	117562	117789
2006	279	63484	5686	713	69449	70162
2007	1070	44696	11456	4438	57222	61660
2008	555	27725	100	1010	28380	29390
2009	694	18054	143	896	18890	19786
2010	1763	7323	1824	27	10909	10936
2011	638	36241	4869	1083	41749	42832
2012	1195	34273	792	43	36260	36303
2013	1174	27968	12095	505	41237	41742
2014	12031	57475	4781	629	74287	74916

CV of Total Biomass (metric tons) in 55-400 m depth strata

	U.S./ Mexico Border to Point Conception	Point Conception to Cape Mendocino	Cape Mendocino to Cape Blanco	Cape Blanco to U.S./ Canada Border	Total South of Cape Blanco	Total Coastwide
2003	1.07	2.37	1.57	1.00	2.62	2.62
2004	1.87	2.61	1.79	1.06	2.81	2.86
2005	1.37	1.53	1.89	1.29	1.72	1.72
2006	2.40	2.08	2.06	1.44	2.27	2.29
2007	1.92	2.30	1.26	1.03	2.66	2.82
2008	2.72	2.95	2.32	1.00	3.02	3.11
2009	2.77	2.39	2.43	1.01	2.50	2.60
2010	2.70	3.63	1.03	1.70	3.95	3.96
2011	2.53	1.77	1.13	1.18	1.99	2.04
2012	2.67	2.55	1.43	1.60	2.69	2.70
2013	2.16	2.99	1.59	1.21	3.42	3.46
2014	1.14	1.29	1.61	1.06	1.61	1.63

Percentage of Positive Tows in 55-400 meter depth strata

	U.S./ Mexico Border to Point Conception	Point Conception to Cape Mendocino	Cape Mendocino to Cape Blanco	Cape Blanco to U.S./ Canada Border	Total South of Cape Blanco	Total Coastwide
2003	44%	65%	22%	1%	45%	26%
2004	33%	62%	34%	3%	48%	26%
2005	31%	52%	25%	3%	39%	22%
2006	16%	44%	29%	4%	33%	19%
2007	23%	41%	27%	2%	32%	17%
2008	40%	44%	18%	1%	38%	21%
2009	42%	38%	21%	1%	35%	20%
2010	46%	57%	20%	2%	45%	25%
2011	34%	44%	18%	4%	36%	21%
2012	44%	51%	21%	4%	42%	26%
2013	51%	76%	43%	3%	62%	33%
2014	53%	62%	49%	2%	57%	30%

Table 5: Tracking of likelihood components and key model outputs with sequential updates to modeling platform and model data

		2007 base model	2007 no time varying growth	2015.SS3 base model	2015.SS3 no time varying growth	2015 update catches	Update com age, length comps	Update rec length comps	Update rec length comps, add selectivity block
SSB0		33390	39879	37751	40582	37713.5	37717	41562	39907.9
R0		34490	41193	39022	41949	38983.7	38987	42962	41252
2015 depletion		0.68	0.62	0.57	0.54	0.57	0.59	0.80	0.59
Total	lambdas	1972.2	2067.1	1998.7	2091.1	1999.3	2106.7	2290.6	2159.9
Likelihood									
indices		43.6	54.2	44.6	58.4	45.9	47.2	40.5	43.8
length_comps		430.1	509.8	435.4	529.0	434.0	445.8	605.8	496.3
age_comps		1479	1484.4	1500.2	1485.2	1501.5	1593.4	1616.8	1598.9
Recruitment		19.5	18.7	18.5	18.5	17.9	20.3	27.5	20.9
Indices									
Fleet		surv_like							
trawl	1	9.9	9.2	9.5	9.3	9.3	9.5	11.5	10.2
triennial	1	8.7	8.7	9.1	8.7	9.7	10.7	7.1	8.9
combined	1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
juvenile	1	0.2	0.2	0.2	0.2	0.2	0.2	0.5	0.5
rec.CPUE	1	23.8	35.1	44.6	34.7	45.9	34.7	40.5	43.8
Length									
trawl	0.1	468.9	679.5	531.9	716.6	528.2	650.6	670.6	656.7
hook	0.1	171.9	170.4	173.7	171.1	173.0	176.1	180.5	177.7
setnet	0.1	228.7	173.8	157.8	163.3	158.4	158.0	159.8	157.5
recreational	1	126.1	111.9	117.4	115.0	117.6	117.0	267.6	162.9
triennial	1 (0.1)	146.4	186.2	158.7	191.4	157.8	157.6	162.9	160.6
combined	0.1	33.6	59.2	33.6	60.5	34.0	33.8	38.6	36.9
rec.CPUE	1	67.4	103.4	69.6	111.5	69.3	69.3	70.4	69.9
Age									
trawl	1	672.7	677	673.6	676.8	675.7	766.5	786.3	770.4
hook	1	266.1	272.6	267.5	270.8	267.4	267.5	266.6	267.7
setnet	1	531.9	526.1	550.7	528.7	550.1	551.8	556.0	553.2
triennial	1								
combined	1	8.2	8.7	8.4	8.9	8.3	7.6	8.0	7.5

Table 5 (continued): Tracking of likelihood components and key model outputs with sequential updates to modeling platform and model data

		Update rec length comps, add selectivity block	Update NWFSC survey index and LF, AF data	Update Triennial Age data	Update YOY rockfish index	Update size-dep fecundity relation	Update maturity relationship	Update aging error matrix	Extend 1999-2006 block to 2014
SSB0		39908	39223	41210	40772	7276980	7433470	6984200	6996180
R0		41252	40544	42598	42145	43381	44073	41410	41481
2015 depletion		0.59	0.75	0.67	0.58	0.55	0.57	0.63	0.63
Total	lambdas	2159.9	2400.0	2320.2	2298.2	2313.1	2329.9	2695.2	2696.2
Likelihood									
indices		43.8	52.7	48.6	80.4	78.4	78.3	80.7	80.7
length_comps		496.3	507.2	392.2	364.5	379.6	395.9	375.8	377.6
age_comps		1598.9	1817.3	1857.6	1828.7	1830.4	1830.8	2208.9	2208.1
Recruitment		20.9	22.8	21.8	24.5	24.7	24.8	29.8	29.8
Indices									
Fleet									
trawl	1	10.2	10.2	9.5	9.5	9.8	9.7	9.2	9.2
triennial	1	8.9	10.9	8.6	8.8	8.1	8.1	9.3	9.2
combined	1	1.0	6.3	6.6	6.4	6.5	6.4	6.4	6.5
juvenile	1	0.5	1.8	1.1	32.9	32.3	32.1	33.3	33.3
rec.CPUE	1	43.8	52.7	48.6	80.4	78.4	78.3	80.7	80.7
Length									
trawl	0.1	656.7	660.6	719.7	717.1	722.4	733.1	738.8	743.0
hook	0.1	177.7	177.7	182.2	181.8	182.9	183.3	186.1	186.5
setnet	0.1	157.5	157.6	150.8	150.9	150.9	150.1	151.9	151.8
recreational	1	162.9	159.9	175.9	150.0	162.8	178.1	150.6	150.8
triennial	1 (0.1)	160.6	159.0	186.9	175.2	179.8	180.1	182.4	187.3
combined	0.1	36.9	185.2	203.5	201.6	209.2	208.7	203.2	209.4
rec.CPUE	1	69.9	70.2	71.9	71.9	72.3	72.3	79.0	79.0
Age									
trawl	1	770.4	770.7	766.3	756.9	757.7	757.8	931.8	931.0
hook	1	267.7	267.5	266.7	266.7	266.8	266.9	281.1	281.1
setnet	1	553.2	553.4	550.1	550.0	550.5	550.0	672.5	672.5
triennial	1			43.2	43.3	43.2	43.2	42.6	42.6
combined	1	7.5	225.6	231.2	211.8	212.3	212.9	281.0	280.8

Table 5 (continued) Tracking of likelihood components and key model outputs with sequential updates to modeling platform and model data

		Extend 1999-2006 block to 2014	Set all lambdas to 0.5 when both AF and LF data (sense)	Retune all indices and comps (BASE MODEL)	Steep ness fixed at 0.34	Steep ness fixed at 0.81	Estimate steepness with 2015 prior	Retrospective (-2 years)	Retrospective (-5 years)
SSB0		6996180	6934760	7052870	9300090	6222560	8659690	7082750	6716950
R0		41481	41117	41817	55141	36894	51344	41994	39825
2015 depletion		0.63	0.57	0.64	0.32	0.79	0.38	0.68	0.51
							(h=0.4)		
Total Likelihood	lambdas	2696.2	2111.2	1657.6	1656.9	1659.4	1657.1	1531.6	1435.1
indices		80.7	75.6	50.6	47.6	51.9	48.9	44.3	43.1
length_comps		377.6	860.6	387.2	391.4	387.3	387.9	357.5	326.8
age_comps		2208.1	1152.0	1195.0	1190.7	1195.5	1194.1	1106.4	1044.1
Recruitment		29.8	23.0	24.8	27.2	24.7	26.2	23.3	21.0
Indices									
Fleet									
trawl	1	9.2	10.3	8.5	9.3	8.2	9.1	8.4	8.0
triennial	1	9.2	8.9	9.3	7.4	10.0	7.9	8.9	9.6
combined	1	6.5	6.4	5.9	6.0	5.9	6.2	5.4	4.9
juvenile	1	33.3	31.1	8.7	9.3	8.8	9.3	3.6	1.4
rec.CPUE	1	80.7	75.6	50.6	47.6	51.9	48.9	44.3	43.1
Length									
trawl	0.1	743.0	626.0	708.6	719.1	703.0	716.4	689.0	668.3
hook	0.1	186.5	167.4	182.7	184.8	182.3	184.0	182.8	182.0
setnet	0.1	151.8	163.7	148.7	155.5	156.2	148.3	155.7	156.1
recreational	1	150.8	155.3	151.0	152.8	151.5	152.2	141.5	128.3
triennial	1 (0.1)	187.3	151.2	174.9	177.1	174.0	176.6	173.6	172.0
combined	0.1	209.4	163.7	488.8	479.9	488.4	465.0	301.0	151.8
rec.CPUE	1	79.0	69.3	65.8	67.0	65.4	66.6	65.8	65.5
Age									
trawl	1	931.0	970.1	657.4	653.8	658.6	654.3	639.4	619.6
hook	1	281.1	285.1	53.3	53.4	53.2	53.4	53.2	53.1
setnet	1	672.5	703.0	166.6	166.5	166.0	166.8	166.0	165.6
triennial	1	42.6	41.7	43.1	42.5	43.2	42.7	42.1	41.7
combined	1	280.8	304.1	274.5	274.5	274.5	276.9	205.6	164.0

Table 6: Comparison of 2007 base model and 2015 update parameter values for estimated (or key fixed) parameters

Parameter	2007	2015	% change	parameter	2007	2015	% change
ln R0	10.45	10.64	2%	1965 rec dev	-0.5	0.31	-161%
K (1970-1979)	0.32	0.17	-47%	1966 rec dev	-0.93	0.21	-122%
K (1980-1988)	0.25	0.24	-1%	1967 rec dev	0.89	0.75	-16%
K (1989-1991)	0.23	0.22	-4%	1968 rec dev	1.05	0.96	-9%
K (1992-1998)	0.2	0.19	-8%	1969 rec dev	-0.89	0.68	-176%
K (1999-2006)	0.26	0.22	-15%	1970 rec dev	1.17	0.87	-26%
Trawl sel inflection	32.65	32.83	1%	1971 rec dev	0.6	-0.26	-146%
Trawl sel width 95% inflection	8.46	8.08	-4%	1972 rec dev	-1.66	-0.36	-77%
Hook sel inflection	37.27	36.2	-3%	1973 rec dev	1.47	1.54	4%
Hook sel width 95% inflection	7.2	6.45	-10%	1974 rec dev	-1.04	-0.65	-36%
Setnet sel peak	59.43	51	-14%	1975 rec dev	1.4	1.29	-8%
Setnet sel top	-2.19	-5.54	0%	1976 rec dev	-0.2	-1.27	544%
Setnet sel asc-width	4.99	4.39	-12%	1977 rec dev	-0.27	-0.71	169%
Setnet sel desc-width	1.98	4.66	114%	1978 rec dev	-0.42	-0.2	-50%
Setnet sel init	-44.77	-11.91	-72%	1979 rec dev	0.87	0.8	-7%
Setnet sel final	-13.05	-20.5	57%	1980 rec dev	-0.38	-0.68	81%
Rec sel peak	41.25	41.08	0%	1981 rec dev	-0.78	-1.13	45%
Rec sel top	-15.76	-11.22	-29%	1982 rec dev	-1.78	-2.27	28%
Rec sel asc-width	4.92	4.86	-1%	1983 rec dev	-1.54	-0.81	-47%
Rec sel desc-width	2.59	3.03	18%	1984 rec dev	1.95	1.97	1%
Rec sel init	-8.25	-8.53	3%	1985 rec dev	-0.74	-1.11	52%
Rec sel final	-0.64	-0.26	-60%	1986 rec dev	0.57	0.43	-25%
Triennial sel size inflect (fixed)	15.7	15.7	0%	1987 rec dev	0.39	0.19	-51%
width 95% inflect (fixed)	0	0	0%	1988 rec dev	0.71	0.71	-1%
Combo sel size inflect	13.34	13.39	0%	1989 rec dev	0.78	0.72	-8%
Combo sel width 95% inflect	12.88	13.12	2%	1990 rec dev	0.02	-0.09	-562%
Rec CPUE sel peak	39.34	38.68	-2%	1991 rec dev	0.57	0.25	-56%
Rec CPUE sel top	-6	-4.91	-18%	1992 rec dev	-0.37	-0.17	-50%
Rec CPUE sel asc-width	3.76	3.69	-2%	1993 rec dev	0.97	0.83	-14%
Rec CPUE sel desc-width	3.45	3.39	-2%	1994 rec dev	-0.15	-0.47	221%
Rec CPUEsel init	-7.66	-7.49	-2%	1995 rec dev	0.04	-0.56	-1385%
Rec CPUE sel final	-1.32	-0.99	-28%	1996 rec dev	-0.78	-0.58	-24%
Rec CPUE age sel peak	1.11	1.11	0%	1997 rec dev	-0.63	-0.92	49%
Rec CPUE age sel top	-60	-59.9	0%	1998 rec dev	-0.09	0.85	-1000%
Rec CPUE age sel asc-width	-24.8	-24.8	0%	1999 rec dev	2.42	2.67	10%
Rec CPUE age sel desc-width	-0.12	-0.12	-3%	2000 rec dev	-1.32	-1.21	-8%
Rec CPUE age sel init	-33.55	-33.5	0%	2001 rec dev	0.06	-0.04	-184%
Rec CPUE age sel final	-4.11	-4.11	0%	2002 rec dev	0.4	-0.26	-167%
Rec sel peak - block offset		-0.59		2003 rec dev	-0.23	0.2	-187%
Rec sel top - block offset		-0.02		2004 rec dev	0.33	-1.34	-507%
Rec sel asc-width - block offset		-1.29		2005 rec dev	-0.91	-1.78	96%
Rec sel desc-width - block offset		-0.13		2006 rec dev	-1.07	-1.6	51%
Rec sel init - block offset		-1.17		2007 rec dev		-0.46	
Rec sel final - block offset		1.99		2008 rec dev		-0.57	
				2009 rec dev		1.35	
				2010 rec dev		1	
				2011 rec dev		-0.46	
				2012 rec dev		-0.21	
				2013 rec dev		0.75	
				2014 rec dev		1.12	

Table 7: Summary results from base model

	Spawning Output (millions larvae)	Spawning Output Std dev	Summary Biomass (age 1+)	Recruitment	Recruitment StdDev	SPR	Exploitation rate	Depletion	Total Catch
Virgin	7053	438	54578	41817	2598	1	0	1	0
Initial	7053	438	54578	41817	2598	1	0	1	0
1892	7053	438	54578	41817	2598	0.960	0.004	1	217
1893	7019	438	54376	41778	2598	0.962	0.004	0.995	205
1894	6989	438	54204	41745	2598	0.964	0.004	0.991	193
1895	6964	438	54060	41716	2598	0.966	0.003	0.987	180
1896	6943	438	53943	41693	2598	0.968	0.003	0.984	171
1897	6927	438	53845	41673	2598	0.970	0.003	0.982	160
1898	6913	438	53767	41658	2598	0.971	0.003	0.98	151
1899	6903	438	53705	41646	2598	0.973	0.003	0.979	140
1900	6895	438	53659	41637	2598	0.971	0.003	0.978	155
1901	6886	438	53602	41626	2598	0.968	0.003	0.976	169
1902	6875	438	53537	41614	2598	0.965	0.003	0.975	185
1903	6863	438	53464	41599	2598	0.962	0.004	0.973	200
1904	6849	438	53383	41584	2598	0.959	0.004	0.971	215
1905	6835	438	53295	41566	2598	0.957	0.004	0.969	229
1906	6819	438	53203	41548	2598	0.954	0.005	0.967	244
1907	6803	438	53105	41529	2598	0.951	0.005	0.965	259
1908	6786	438	53002	41508	2598	0.948	0.005	0.962	274
1909	6768	438	52895	41487	2598	0.942	0.006	0.96	307
1910	6746	438	52767	41461	2598	0.936	0.006	0.956	342
1911	6721	438	52619	41431	2599	0.930	0.007	0.953	377
1912	6693	438	52452	41397	2599	0.923	0.008	0.949	411
1913	6662	438	52268	41359	2599	0.917	0.009	0.945	445
1914	6628	438	52070	41318	2599	0.911	0.009	0.94	479
1915	6592	438	51859	41273	2600	0.905	0.01	0.935	514
1916	6555	438	51635	41226	2600	0.870	0.014	0.929	724
1917	6487	438	51236	41140	2601	0.806	0.022	0.92	1149
1918	6359	438	50478	40973	2602	0.799	0.023	0.902	1176
1919	6237	438	49766	40810	2604	0.858	0.015	0.884	759
1920	6193	438	49508	40749	2605	0.851	0.016	0.878	798
1921	6147	438	49236	40686	2606	0.870	0.014	0.872	678
1922	6125	438	49100	40656	2607	0.879	0.013	0.868	625
1923	6114	438	49023	40640	2607	0.856	0.016	0.867	761
1924	6082	439	48822	40595	2608	0.852	0.016	0.862	780
1925	6050	439	48619	40549	2609	0.835	0.018	0.858	878
1926	6005	439	48341	40485	2610	0.788	0.025	0.851	1189
1927	5915	439	47796	40353	2612	0.811	0.021	0.839	1017
1928	5860	439	47460	40271	2614	0.812	0.021	0.831	1000
1929	5813	439	47167	40199	2616	0.815	0.021	0.824	971
1930	5774	439	46926	40141	2617	0.795	0.023	0.819	1095
1931	5720	439	46589	40057	2619	0.783	0.025	0.811	1165
1932	5659	440	46213	39960	2622	0.833	0.018	0.802	836
1933	5654	440	46175	39953	2623	0.863	0.014	0.802	663
1934	5678	440	46298	39991	2622	0.856	0.015	0.805	704
1935	5694	440	46368	40016	2622	0.848	0.016	0.807	754
1936	5700	441	46382	40025	2622	0.881	0.012	0.808	568
1937	5734	441	46565	40078	2621	0.891	0.011	0.813	519
1938	5772	441	46775	40137	2620	0.898	0.01	0.818	487
1939	5812	442	46996	40198	2619	0.888	0.012	0.824	543

Table 7 (continued)

	Spawning Output (millions larvae)	Spawning Output Std dev	Summary Biomass (age 1+)	Recruitment	Recruitment StdDev	SPR	Exploitation rate	Depletion	Total Catch
1940	5839	442	47144	40239	2619	0.898	0.01	0.828	492
1941	5871	442	47328	40287	2618	0.910	0.009	0.832	430
1942	5910	442	47554	40345	2617	0.961	0.004	0.838	178
1943	5984	442	47998	40454	2615	0.921	0.008	0.848	381
1944	6022	442	48212	40509	2614	0.800	0.023	0.854	1101
1945	5949	442	47729	40404	2616	0.650	0.048	0.843	2283
1946	5704	442	46171	40032	2624	0.700	0.038	0.809	1759
1947	5554	442	45238	39791	2630	0.754	0.029	0.787	1316
1948	5480	442	44806	39670	2633	0.799	0.022	0.777	1008
1949	5460	442	44705	39636	2634	0.779	0.025	0.774	1132
1950	5426	442	44496	39579	2636	0.729	0.033	0.769	1464
1951	5346	442	43989	39443	2640	0.690	0.039	0.758	1733
1952	5233	442	43266	39242	2647	0.760	0.028	0.742	1206
1953	5206	442	43092	39195	2649	0.726	0.033	0.738	1427
1954	5151	443	42720	39094	2653	0.731	0.032	0.73	1378
1955	5106	443	42420	39011	2657	0.639	0.049	0.724	2063
1956	4963	443	41492	38741	2668	0.688	0.039	0.704	1620
1957	4896	444	41050	38609	2674	0.624	0.051	0.694	2106
1958	4763	444	40180	38340	2687	0.636	0.049	0.675	1953
1959	4661	444	39519	38126	2698	0.673	0.041	0.661	1635
1960	4613	445	39206	38023	2705	0.660	0.044	0.654	1713
1961	4557	446	38840	37901	2713	0.755	0.028	0.646	1082
1962	4596	447	39092	37987	2711	0.766	0.026	0.652	1028
1963	4642	448	39372	38086	2708	0.658	0.044	0.658	1740
1964	4581	449	38954	37954	2717	0.699	0.037	0.65	1437
1965	4567	450	38846	31356	24694	0.687	0.039	0.648	1511
1966	4540	448	38674	28279	24293	0.559	0.065	0.644	2529
1967	4367	445	37321	48218	46283	0.496	0.083	0.619	3082
1968	4117	427	35262	58385	54642	0.619	0.052	0.584	1818
1969	4046	407	35002	43957	44239	0.758	0.027	0.574	960
1970	4118	387	36281	53490	31013	0.721	0.032	0.584	1163
1971	4164	338	36899	17075	12454	0.748	0.028	0.59	1015
1972	4254	286	38106	15542	10959	0.675	0.038	0.603	1441
1973	4308	238	37896	105833	12719	0.498	0.077	0.611	2929
1974	4150	201	35628	11588	7580	0.449	0.095	0.588	3391
1975	3853	178	35530	79977	7655	0.475	0.082	0.546	2907
1976	3729	166	34268	6033	3414	0.462	0.085	0.529	2912
1977	3614	166	34754	10463	3757	0.516	0.066	0.512	2293
1978	3636	178	34146	17407	4197	0.578	0.054	0.516	1827
1979	3687	192	33257	48367	4667	0.480	0.082	0.523	2736
1980	3532	196	31004	10744	3371	0.439	0.101	0.501	3141
1981	3391	165	30200	6740	1948	0.466	0.093	0.481	2800
1982	3275	142	28853	2128	936	0.485	0.087	0.464	2521
1983	3145	129	26947	9017	2332	0.488	0.092	0.446	2469
1984	2923	119	24262	143852	6410	0.425	0.121	0.414	2934
1985	2592	112	20784	6232	2192	0.381	0.155	0.368	3217
1986	2144	105	21632	27128	3440	0.354	0.146	0.304	3157
1987	2059	103	22351	21005	4312	0.407	0.092	0.292	2065
1988	2314	109	24116	37151	5868	0.355	0.116	0.328	2790
1989	2442	117	24384	38246	5355	0.330	0.141	0.346	3438

Table 7 (continued)

	Spawning Output (millions larvae)	Spawning Output Std dev	Summary Biomass (age 1+)	Recruitment	Recruitment StdDev	SPR	Exploitation rate	Depletion	Total Catch
1990	2341	119	23438	16667	3708	0.348	0.135	0.332	3156
1991	2238	127	22853	23117	4073	0.325	0.146	0.317	3347
1992	2116	139	21569	14659	4143	0.352	0.129	0.3	2774
1993	1970	140	20167	39167	6527	0.366	0.12	0.279	2412
1994	1863	145	18801	10313	3239	0.414	0.101	0.264	1891
1995	1800	151	18577	9295	3221	0.389	0.109	0.255	2034
1996	1731	161	17656	8891	3139	0.395	0.106	0.245	1880
1997	1672	173	16575	6227	2488	0.356	0.128	0.237	2116
1998	1541	183	14990	35394	10222	0.437	0.096	0.218	1435
1999	1471	192	13773	213306	32999	0.530	0.071	0.209	978
2000	1534	212	14018	4467	2392	0.642	0.045	0.217	632
2001	1646	234	21285	14837	4272	0.697	0.024	0.233	518
2002	2243	322	27082	13801	3859	0.825	0.012	0.318	320
2003	3035	443	31927	24776	5107	0.991	0.001	0.43	21
2004	3726	545	35274	5653	1898	0.951	0.004	0.528	153
2005	4191	615	37226	3754	1386	0.976	0.002	0.594	85
2006	4499	660	37618	4578	1595	0.967	0.003	0.638	126
2007	4636	679	36720	14471	3433	0.964	0.004	0.657	137
2008	4617	675	34941	12856	3504	0.961	0.004	0.655	148
2009	4473	653	32952	88370	16234	0.917	0.01	0.634	318
2010	4274	627	30765	61308	12844	0.891	0.013	0.606	397
2011	4054	598	31219	13854	4417	0.901	0.011	0.575	331
2012	4013	594	33147	17894	5665	0.904	0.009	0.569	307
2013	4176	622	34643	47368	14916	0.880	0.012	0.592	405
2014	4364	661	35517	69760	53743	0.908	0.009	0.619	325
2015	*4515*	*692*	*36797*	*37810*	*37931*			*0.64*	
2016	*4387*	*712*	*37223*	*37517*	*37648*			*0.622*	
2017	*4347*	*743*	*37502*	*37423*	*37563*			*0.616*	
2018	*4191*	*807*	*36647*	*37045*	*37205*			*0.594*	
2019	*4069*	*903*	*35859*	*36736*	*36923*			*0.577*	
2020	*3953*	*1007*	*35034*	*36429*	*36647*			*0.56*	
2021	*3837*	*1107*	*34176*	*36110*	*36365*			*0.544*	
2022	*3725*	*1195*	*33330*	*35788*	*36082*			*0.528*	
2023	*3620*	*1270*	*32533*	*35473*	*35808*			*0.513*	
2024	*3524*	*1333*	*31804*	*35173*	*35551*			*0.5*	
2025	*3437*	*1387*	*31149*	*34894*	*35315*			*0.487*	
2026	*3360*	*1434*	*30565*	*34638*	*35102*			*0.476*	

Table 8: Base model reference points

Reference Points

	Estimate	St.Dev	Lower ~95% CL	Upper ~95% CL
SSB_Unfished (millions larvae)	7053	438	6615	7491
SmryBio_Unfished	54578	3375	51203	57953
Recr_Unfished	41817	2598	39219	44415

	Yield	Depletion	SSB	SPR	F
Btarget	2136	0.400	2821	0.485	0.082
SPR target	2115	0.420	2963	0.500	0.078
MSY	2165	0.339	2390	0.438	0.095

Table 9: Forecast catches

	ACL catches	OFL catches
2015	1758	1833
2016	1749	1824
2017	2803	2932
2018	2707	2820
2019	2671	2773
2020	2635	2727
2021	2583	2666
2022	2521	2595
2023	2457	2525
2024	2397	2458
2025	2343	2399
2026	2294	2346

Table 10: Decision table, with the 2007 steepness point estimate (base) and +/- standard deviation (low and high productivity) as states of nature, and catch streams based on status quo (average of past five years), revised ACL and OFL catch limits from the base (2015) assessment.

		State 1 (h=0.34)		Base (h=0.57)		State 2 (h=0.81)	
Year	Status quo catches	larvae (millions)	depletion	larvae (millions)	depletion	larvae (millions)	depletion
2015	346	2985	0.32	4515	0.64	4926	0.79
2016	346	2991	0.32	4590	0.65	5001	0.80
2017	346	3027	0.33	4742	0.67	5150	0.83
2018	346	3088	0.33	4935	0.70	5332	0.86
2019	346	3165	0.34	5121	0.73	5494	0.88
2020	346	3248	0.35	5285	0.75	5623	0.90
2021	346	3336	0.36	5424	0.77	5718	0.92
2022	346	3426	0.37	5542	0.79	5785	0.93
2023	346	3516	0.38	5641	0.80	5829	0.93
2024	346	3607	0.39	5725	0.81	5855	0.94
2025	346	3698	0.40	5797	0.82	5868	0.94
2026	346	3789	0.41	5859	0.83	5872	0.94
	ACL catches	larvae (millions)	depletion	larvae (millions)	depletion	larvae (millions)	depletion
2015	1758	2997	0.32	4515	0.64	4901	0.79
2016	1749	2801	0.30	4387	0.62	4784	0.77
2017	2803	2645	0.28	4346	0.62	4750	0.76
2018	2707	2378	0.26	4210	0.60	4607	0.74
2019	2671	2162	0.23	4104	0.58	4481	0.72
2020	2635	1976	0.21	4000	0.57	4346	0.7
2021	2583	1809	0.19	3894	0.55	4203	0.68
2022	2521	1651	0.18	3789	0.54	4060	0.65
2023	2457	1500	0.16	3689	0.52	3923	0.63
2024	2397	1353	0.15	3597	0.51	3796	0.61
2025	2343	1206	0.13	3514	0.50	3681	0.59
2026	2294	1060	0.11	3439	0.49	3581	0.58
	OFL catches	larvae (millions)	depletion	larvae (millions)	depletion	larvae (millions)	depletion
2015	1758	2995	0.32	4515	0.64	4926	0.79
2016	1749	2806	0.30	4387	0.62	4798	0.77
2017	2932	2655	0.29	4346	0.62	4755	0.76
2018	2820	2372	0.26	4192	0.59	4586	0.74
2019	2773	2143	0.23	4071	0.58	4442	0.71
2020	2727	1946	0.21	3954	0.56	4293	0.69
2021	2666	1768	0.19	3838	0.54	4141	0.66
2022	2595	1602	0.17	3725	0.53	3991	0.64
2023	2525	1444	0.16	3619	0.51	3849	0.62
2024	2458	1289	0.14	3521	0.50	3720	0.60
2025	2399	1136	0.12	3434	0.49	3605	0.58
2026	2346	983	0.11	3356	0.48	3504	0.56

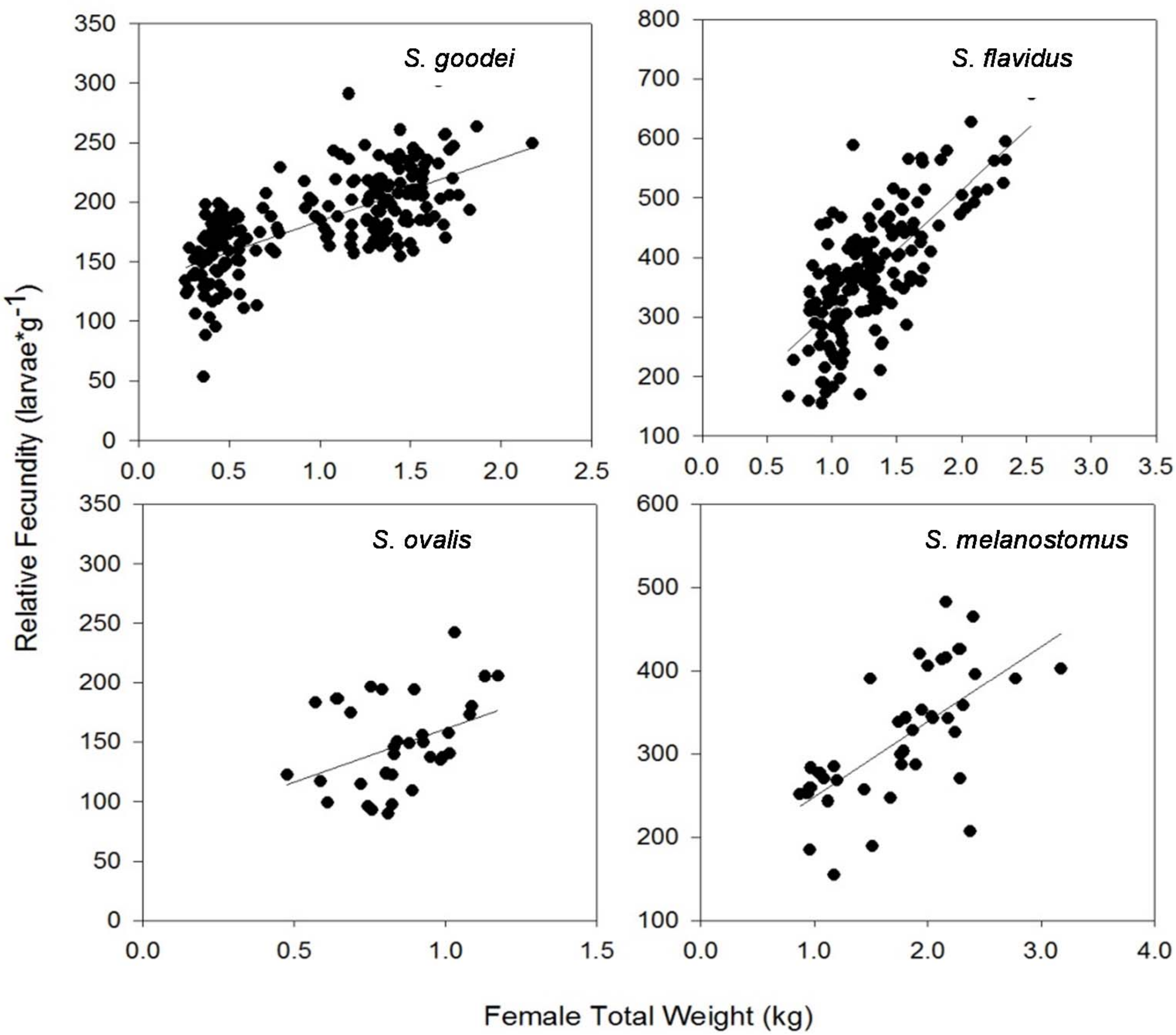


Fig. 1 Increase in relative fecundity (Φrel) with maternal size (W; kg) for Chilipepper (a), Yellowtail rockfish (b), Speckled rockfish (c), and Blackgill rockfish (d), taken from Beyer et al. (2015). Other species are shown solely for comparative purposes.

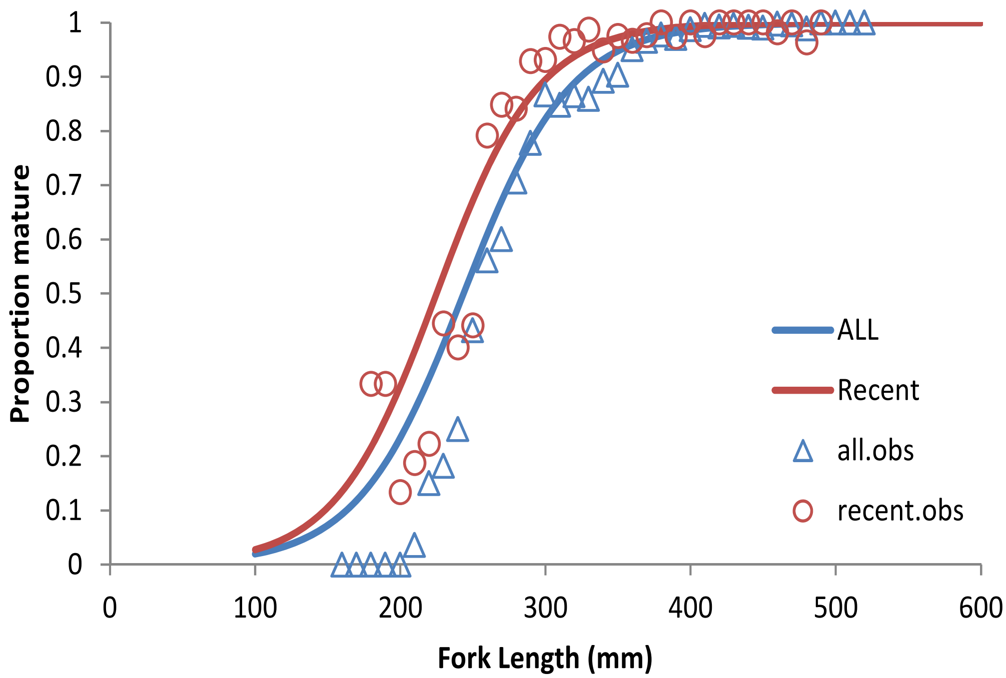


Figure 2: Re-estimated maturity curve for female Chilipepper Rockfsih

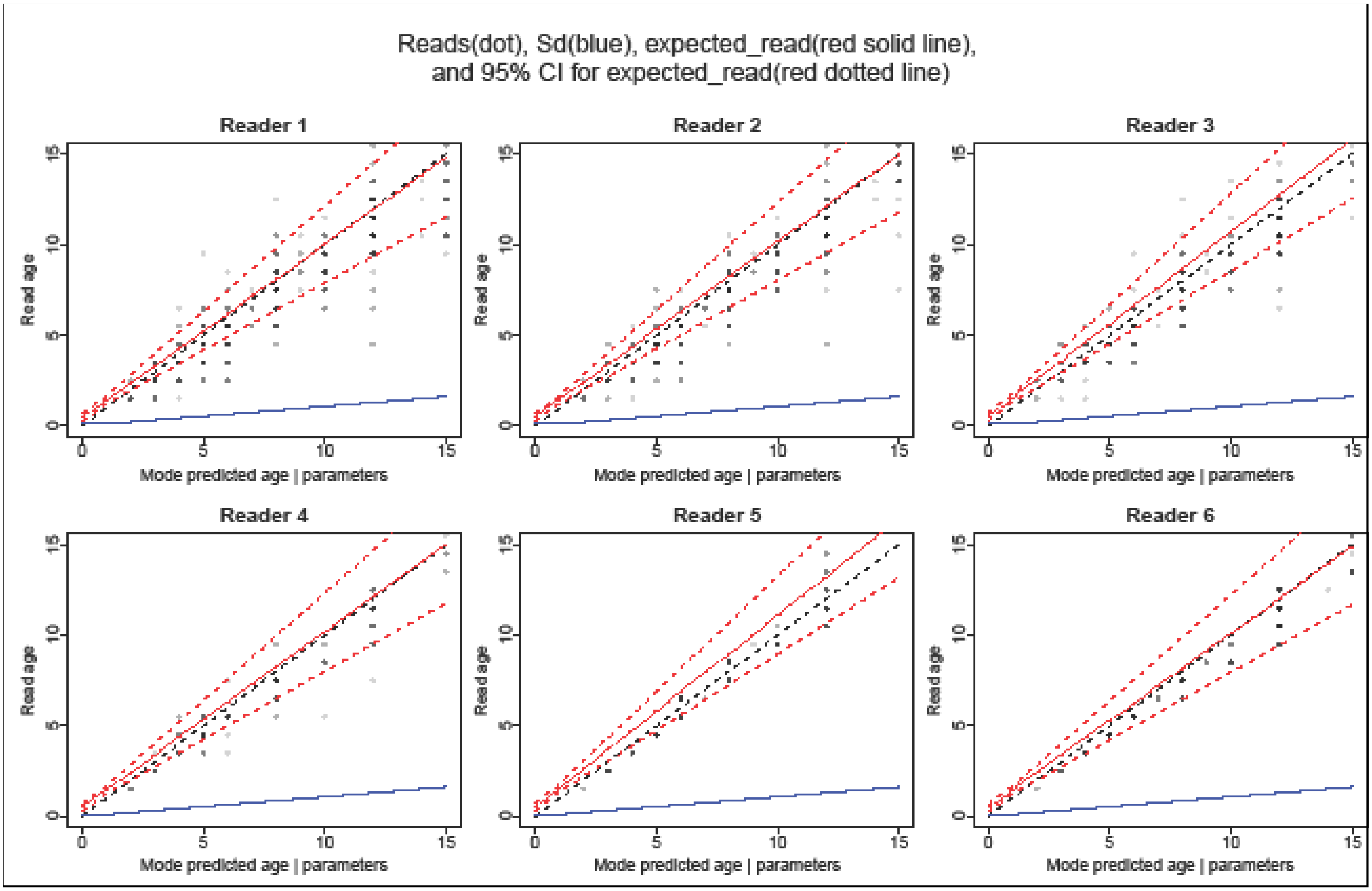
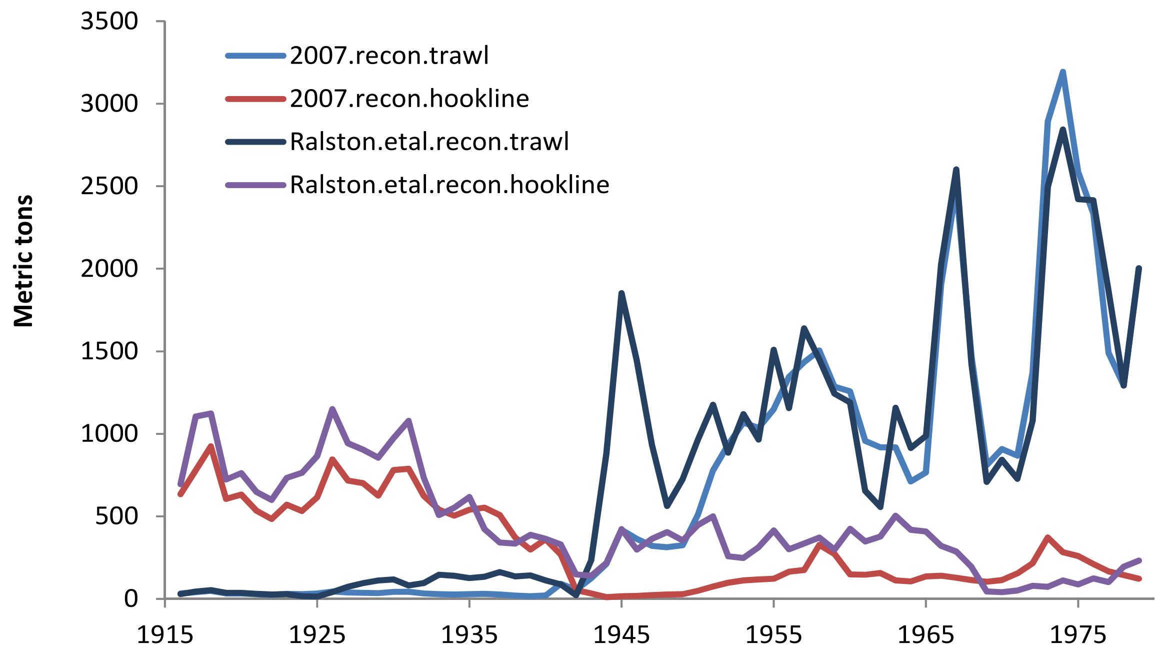


Figure 3: Diagnostics from age error analysis.



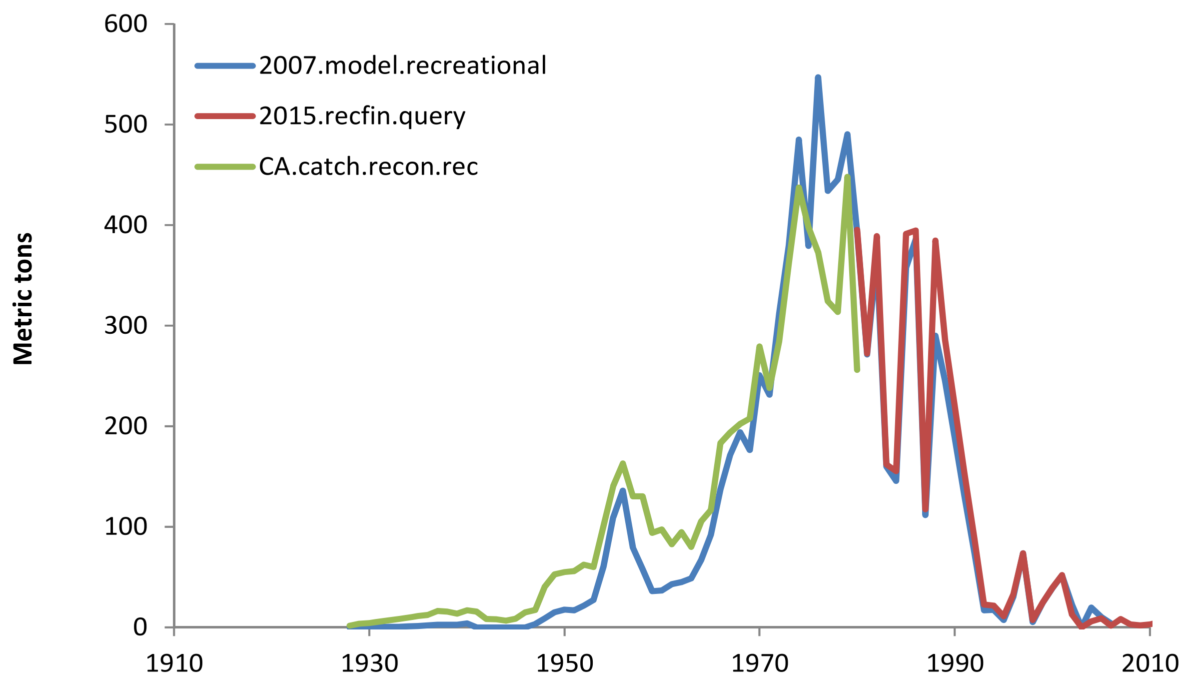


Figure 4a (top) and b (bottom): 2007 and 2015 catch estimates for commercial (top) and recreational (bottom) fisheries. .

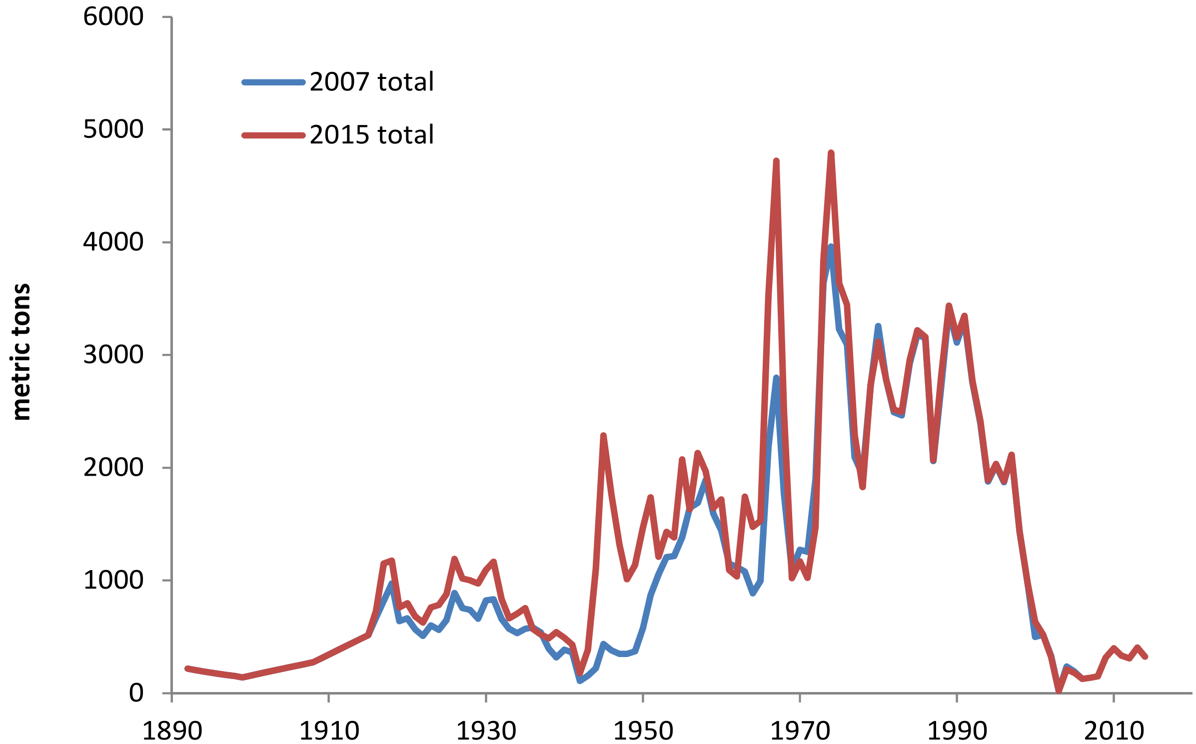


Figure 5: Changes in total catch estimates between the 2007 and 2015 model

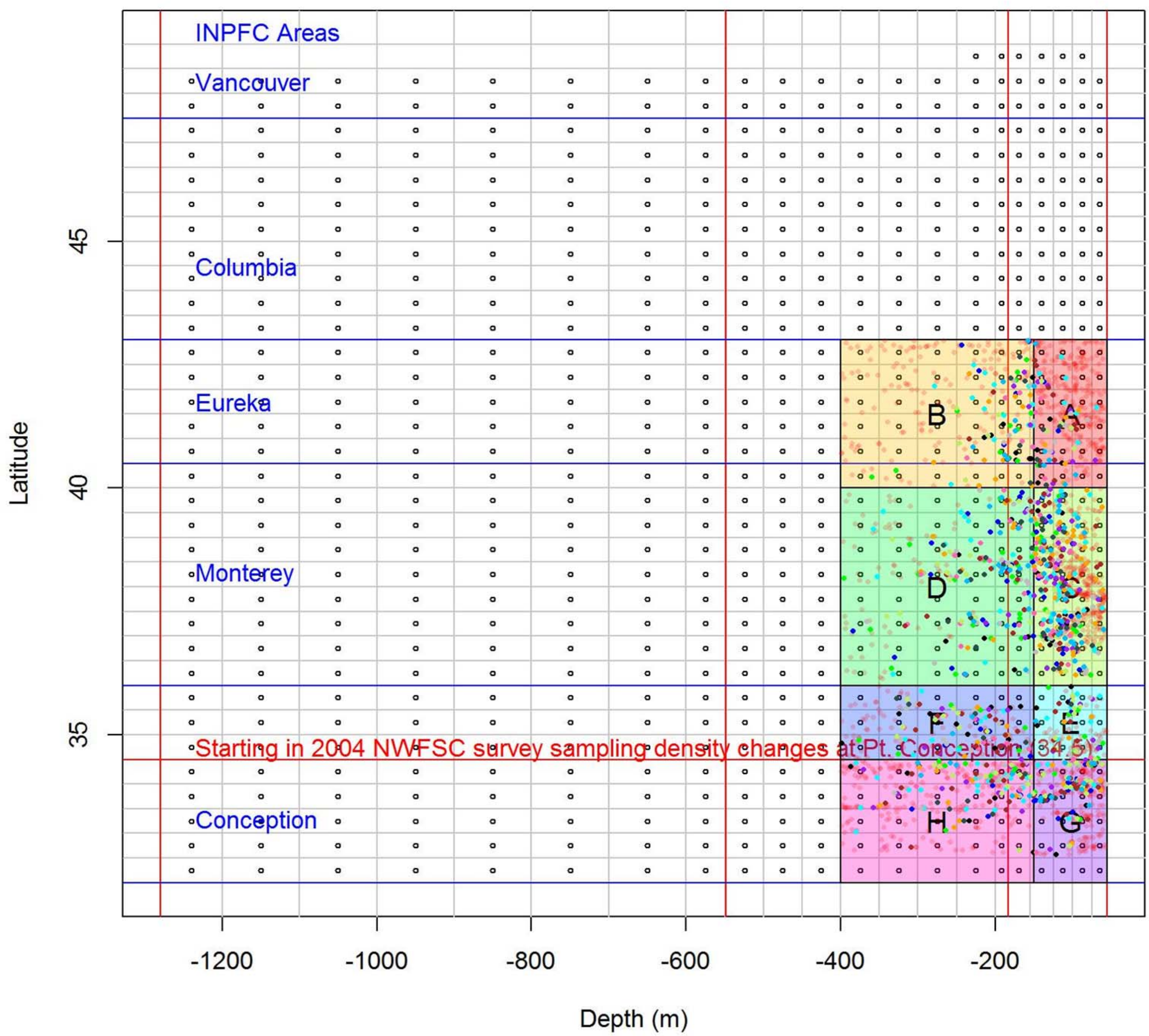
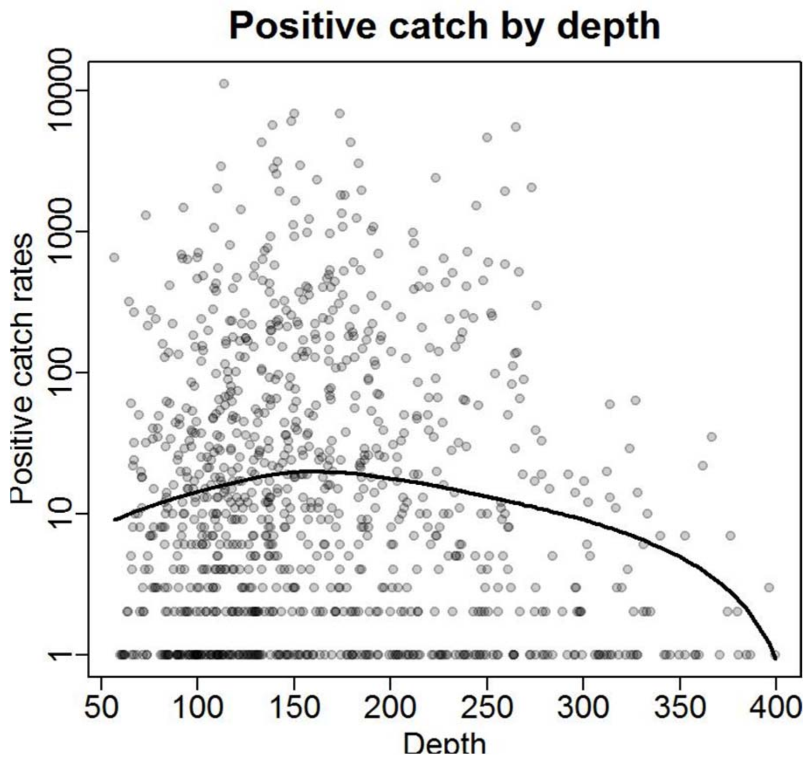


Figure 6: Depth and latitude stratification for the NWFSC Combined Trawl survey Delta-GLM model.



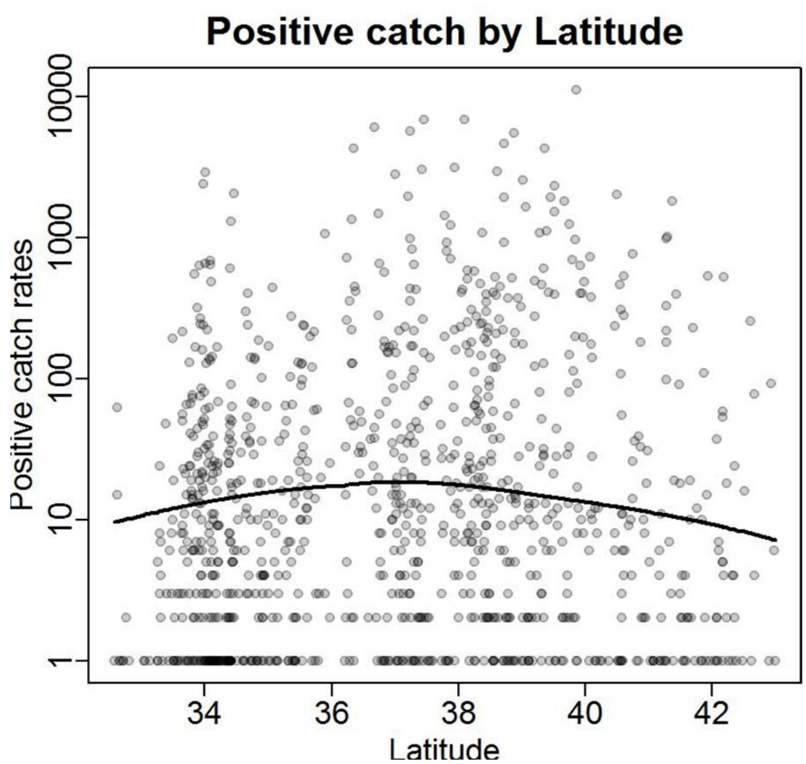


Figure 7a (top) and b (bottom): Catches (log scale) of Chilipepper rockfish by depth and latitude (from within the stratification boundaries).

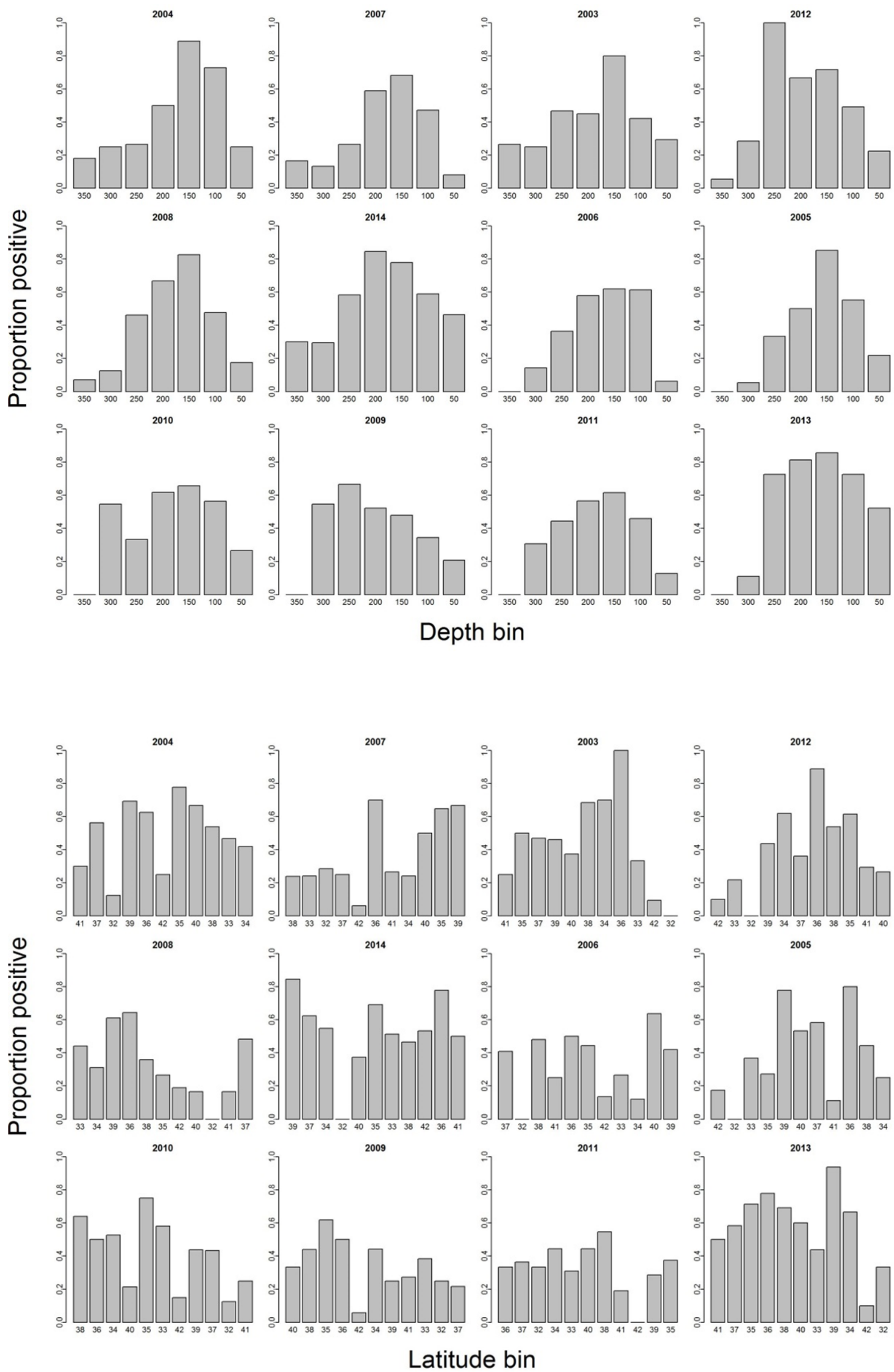


Figure 8a (top) and b (bottom): Proportion of positive tows (within stratification boundaries) for Chilipepper Rockfish by year and depth, and year and latitude, from the Combined NWFSC trawl survey

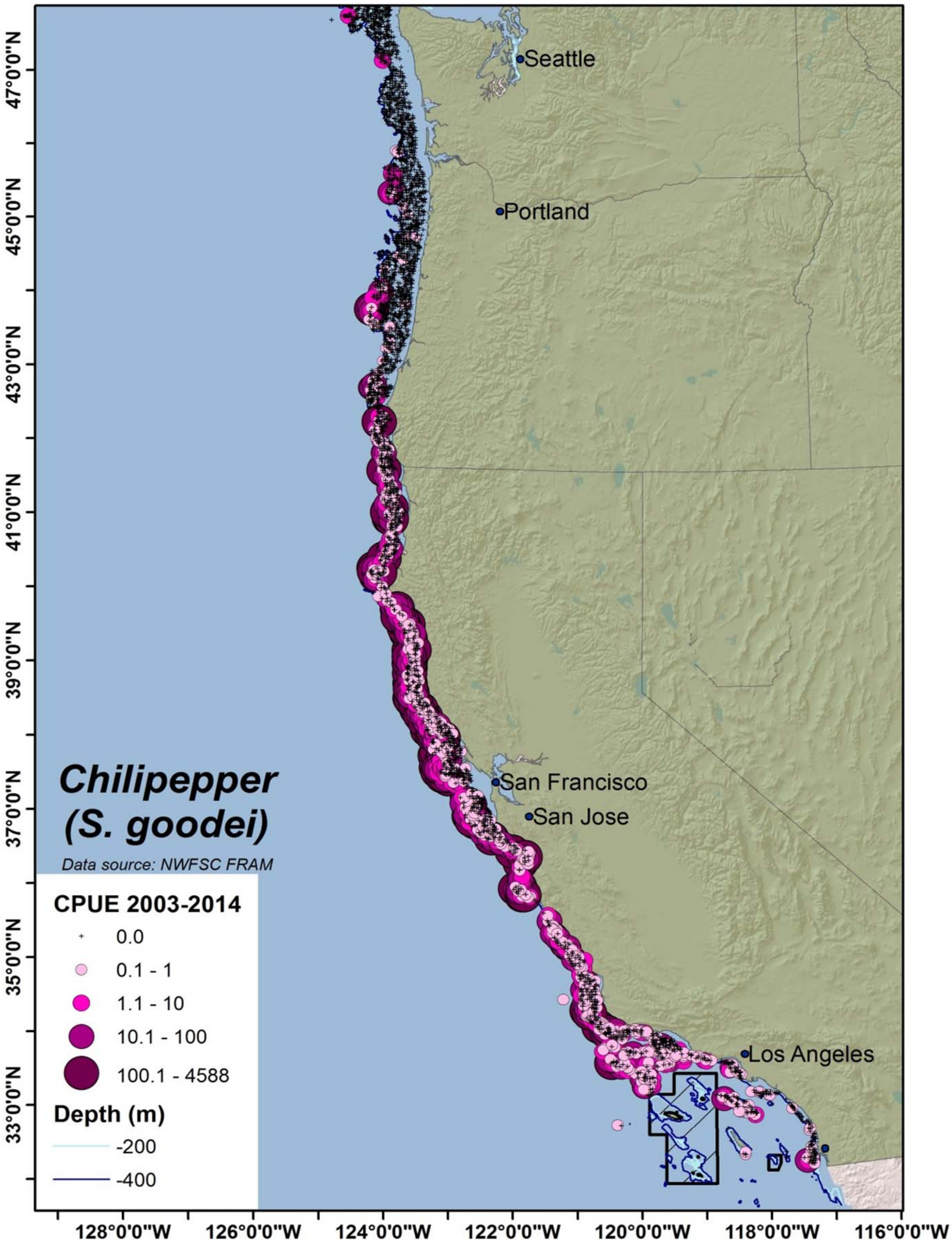


Figure 9: Coatwide view of catch rates of Chilipepper rockfish from the NWFSC combined trawl survey (within depth stratification used in Delta-GLOM, of 55-400 meters).

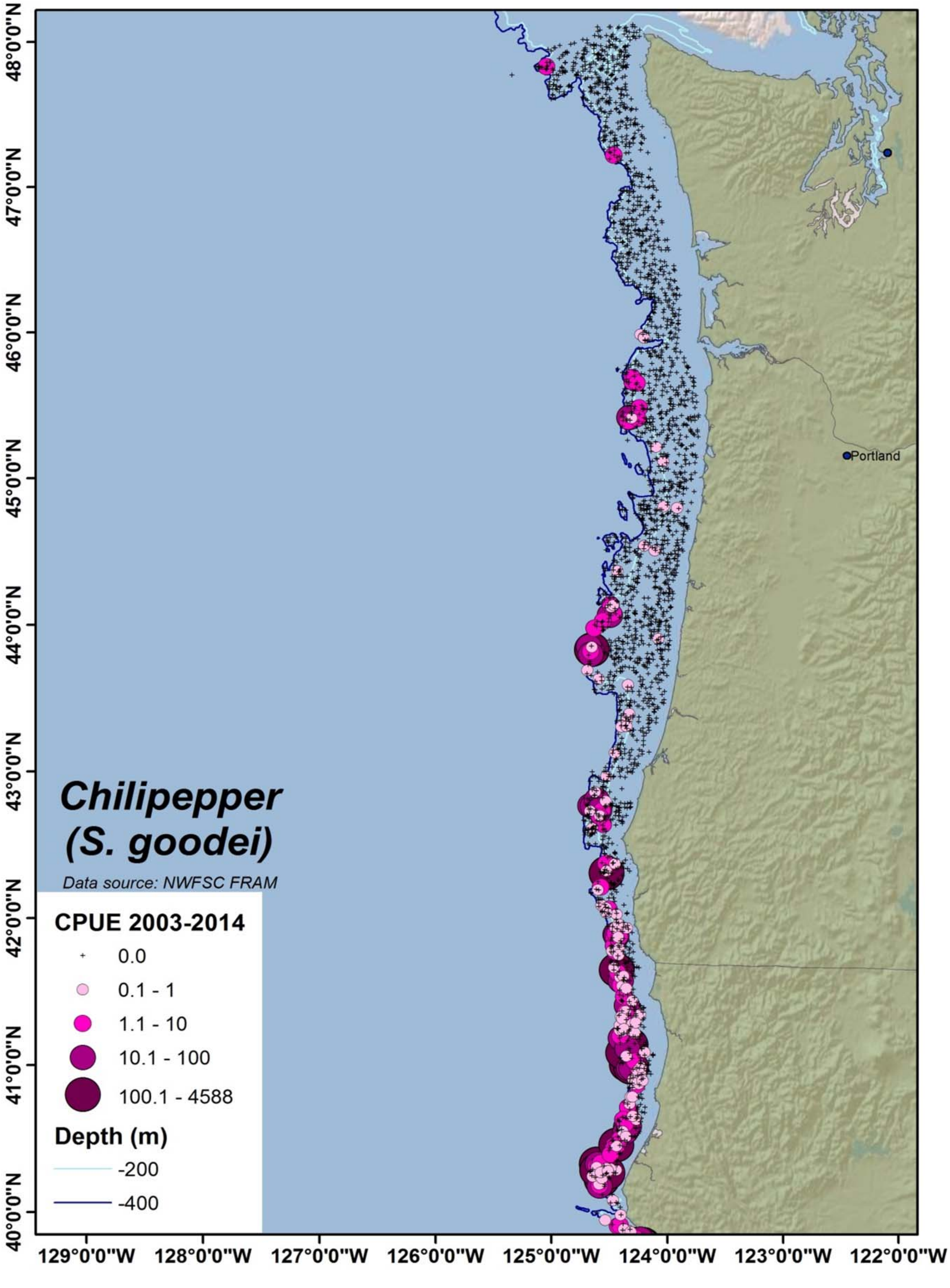


Figure 10: Cape Mendocino to Cape Flattery view of catch rates of Chilipepper rockfish from the NWFSC combined trawl survey (within depth stratification used in Delta-GLOM, of 55-400 meters).

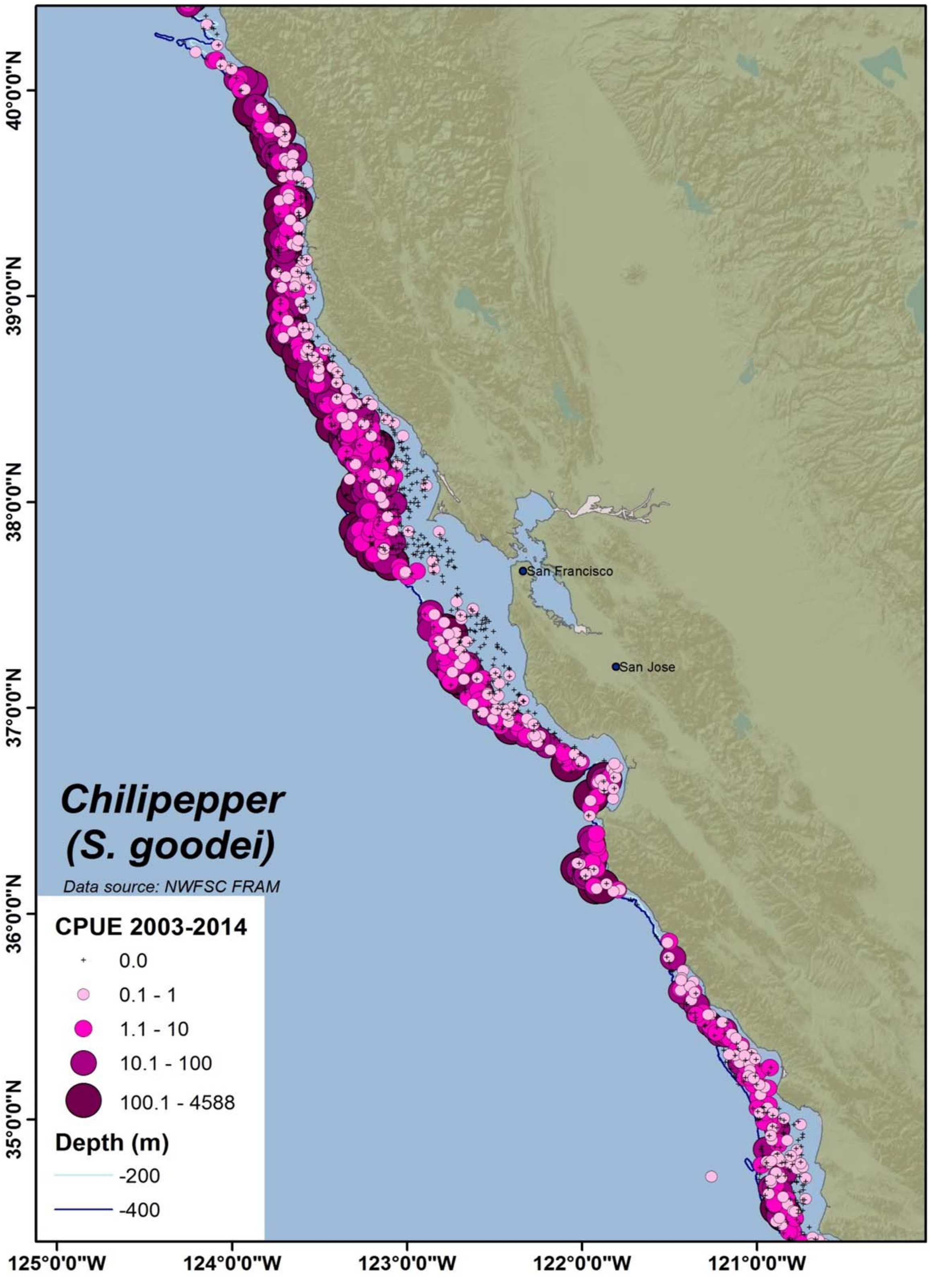


Figure 11: Point Conception to Cape Mendocino view of catch rates of Chilipepper rockfish from the NWFSC combined trawl survey (within depth stratification used in Delta-GLOM, of 55-400 meters).

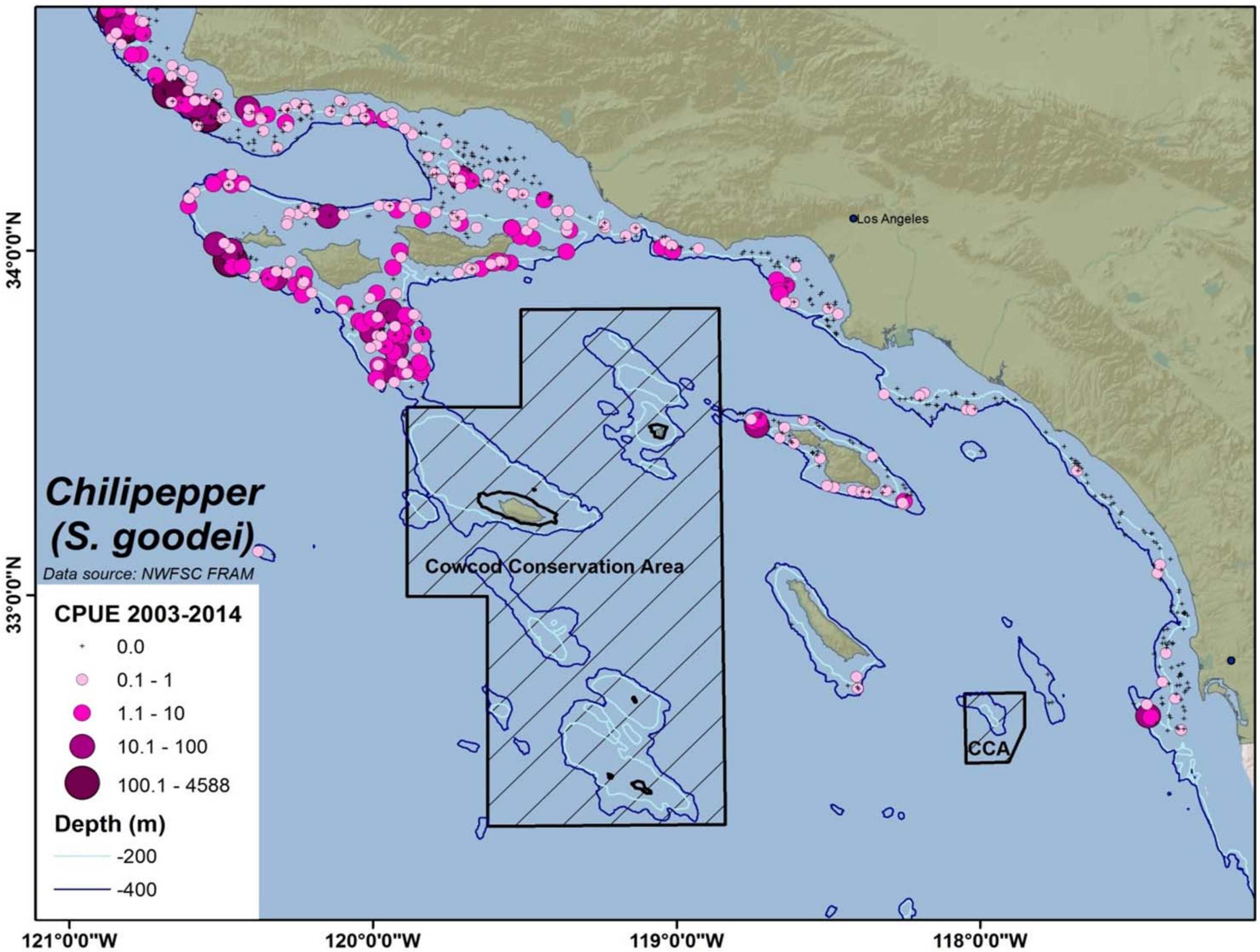


Figure 12: Southern California Bight view of catch rates of Chilipepper rockfish from the NWFSC combined trawl survey (within depth stratification used in Delta-GLOM, of 55-400 meters).

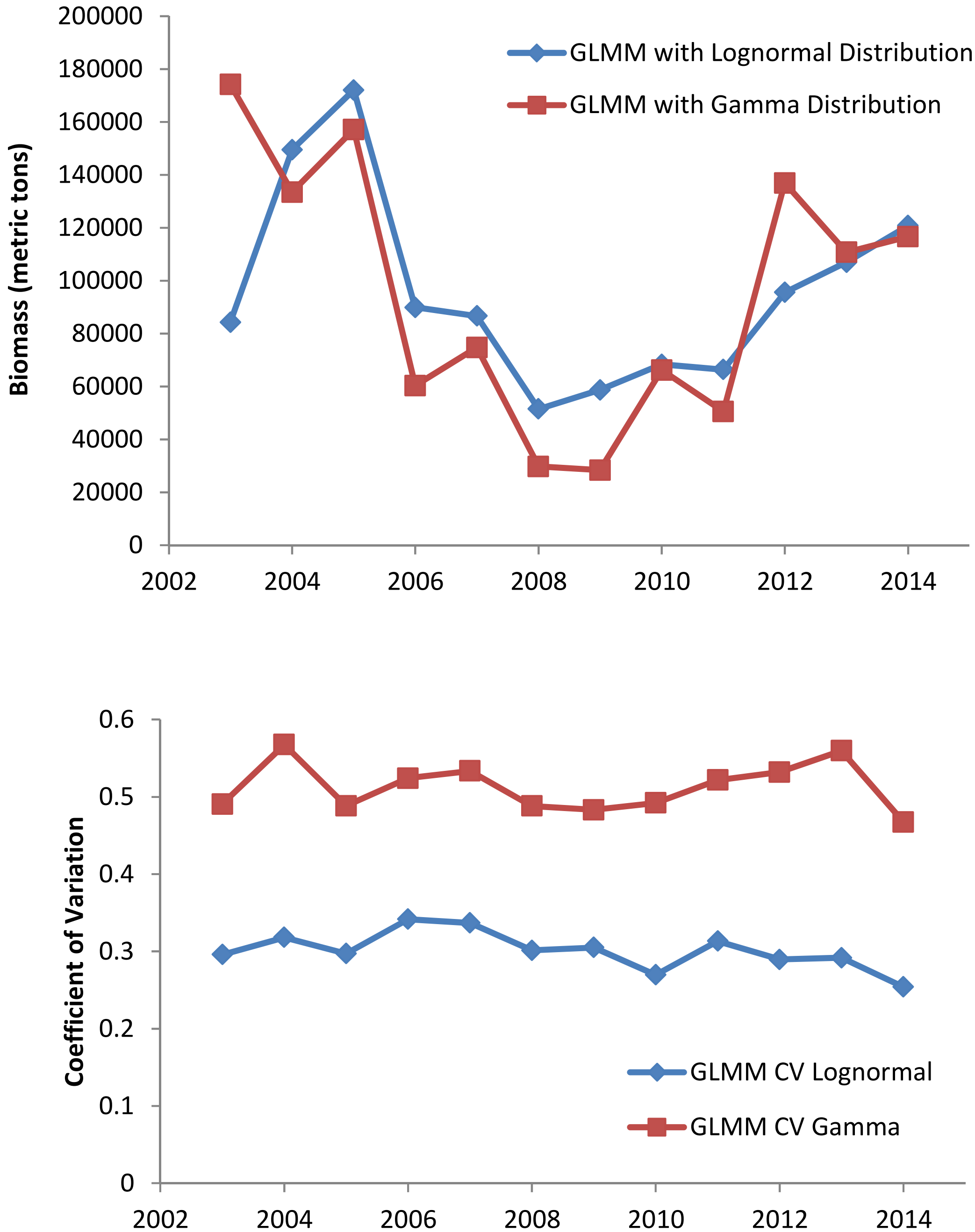


Figure 13a (top) and b (bottom): Relative abundance indices and estimated CVs from the NWFSC Combined bottom trawl survey based on alternative error structures in the Delta-GLM.

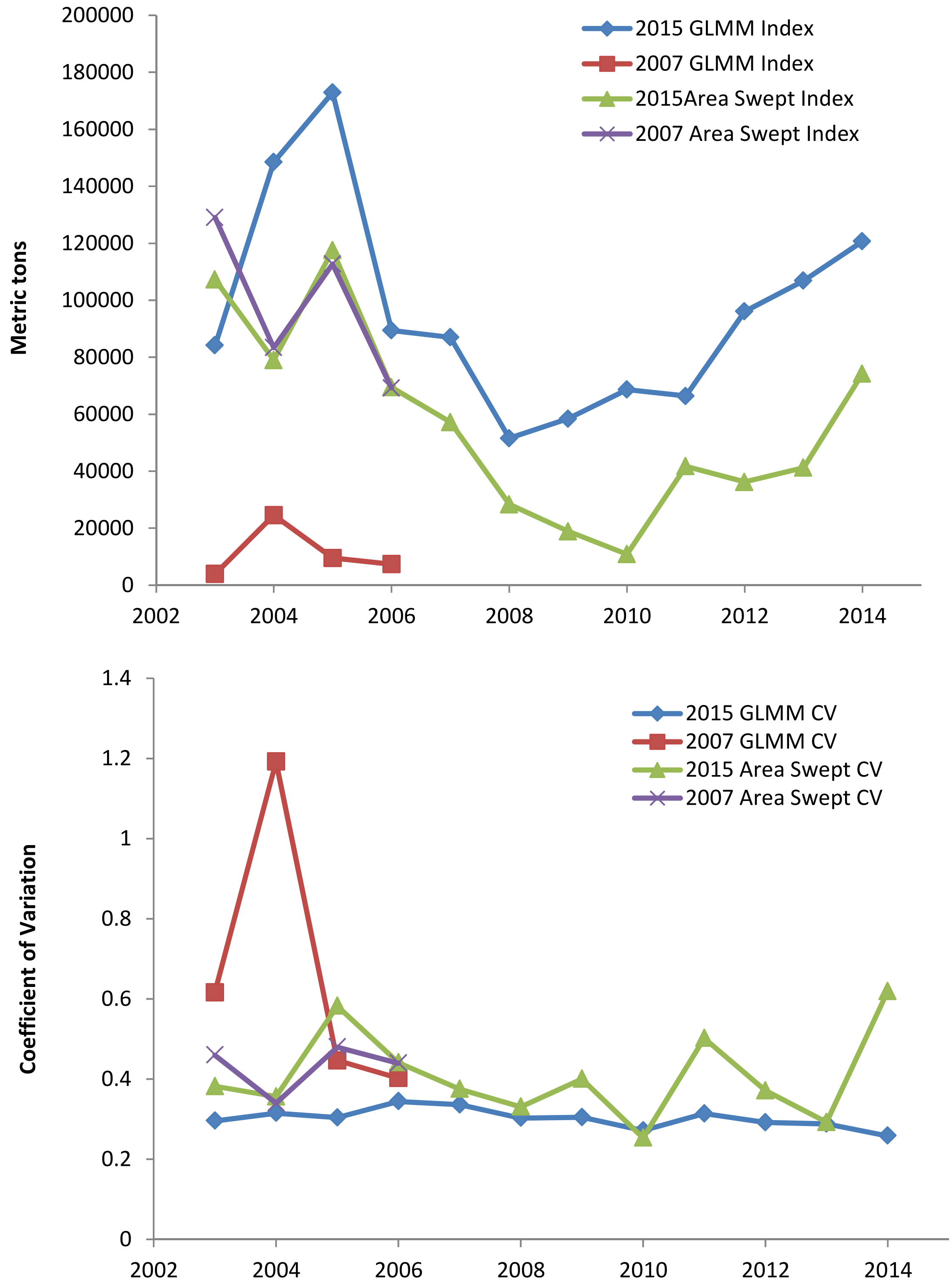


Figure 14a (top) and b (bottom): Relative abundance indices and estimated CVs from the NWFSC Combined bottom trawl survey indices from the 2007 model and the 2015 model.

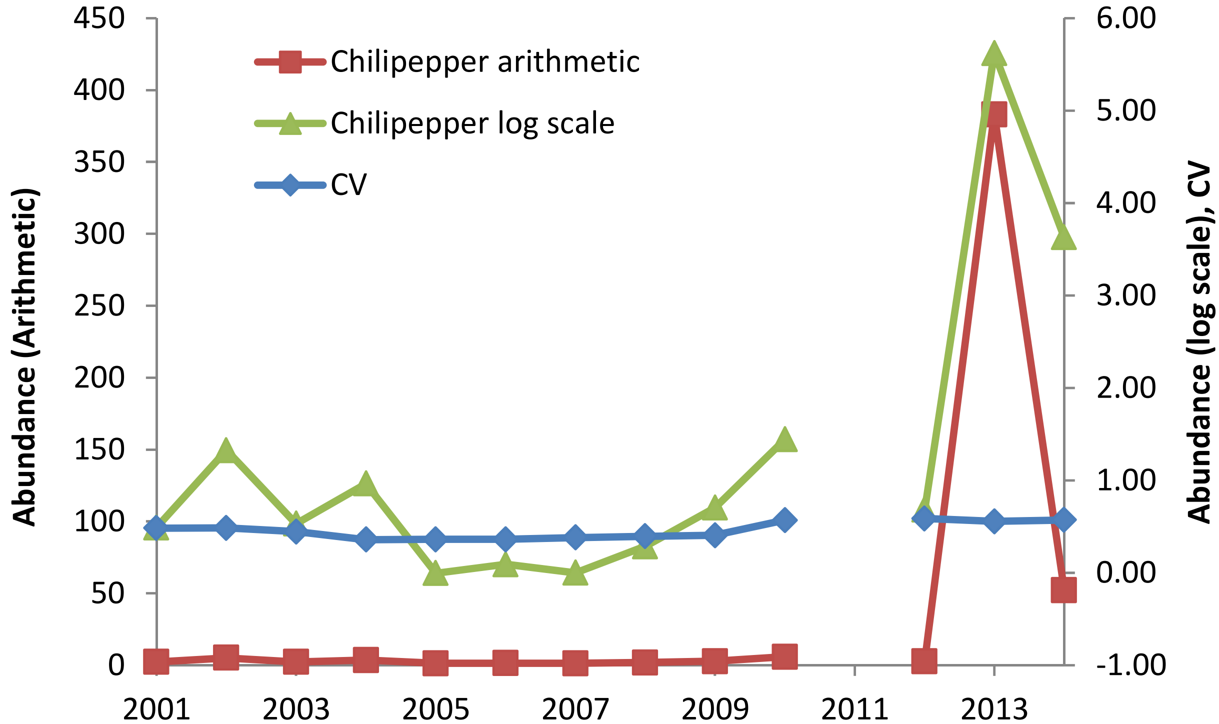


Figure 15: Coastwide juvenile abundance index (in arithmetic and log scale) and associated coefficient of varation for Chilipepper Rockfish (from Ralston et al.).

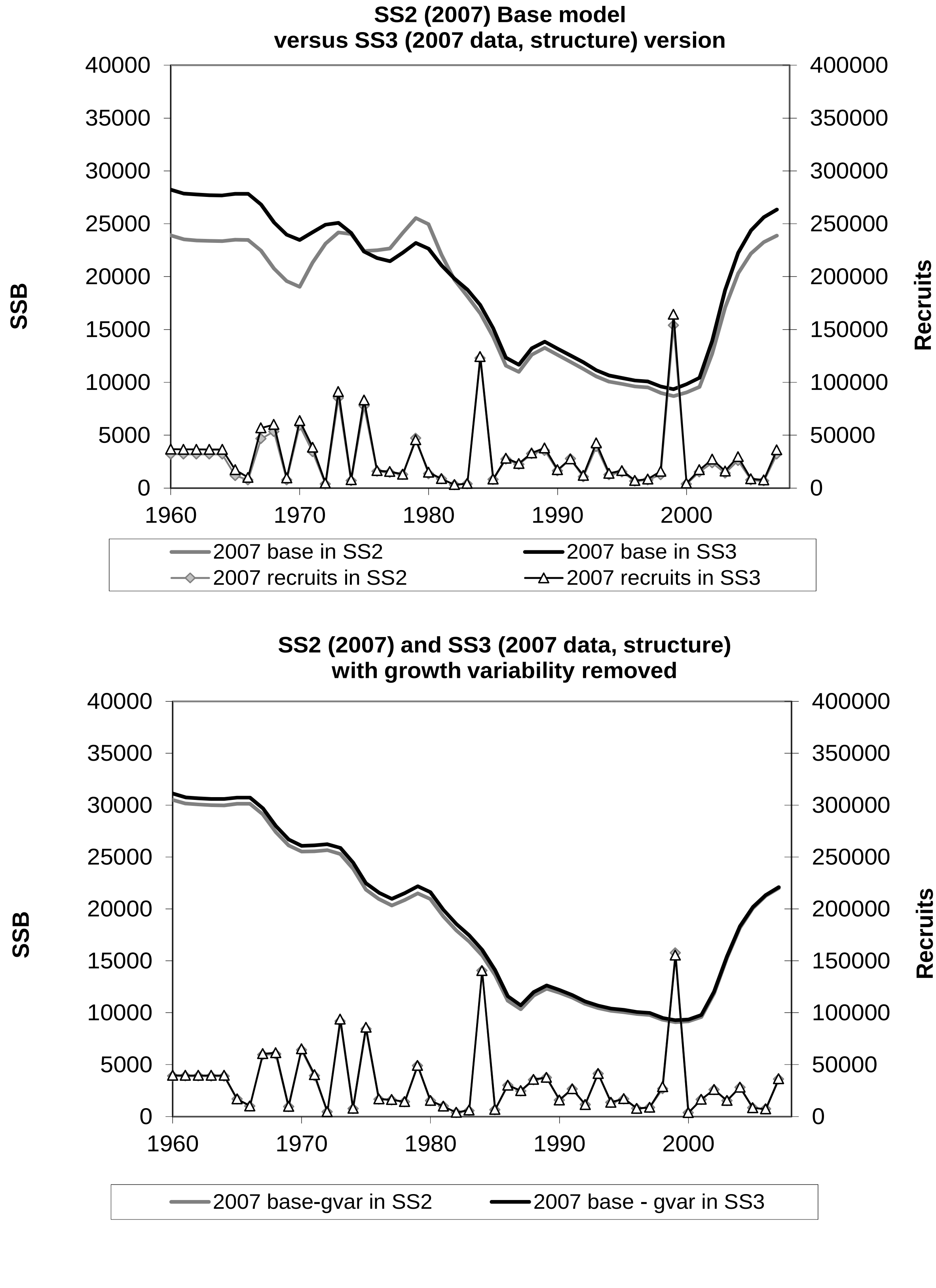
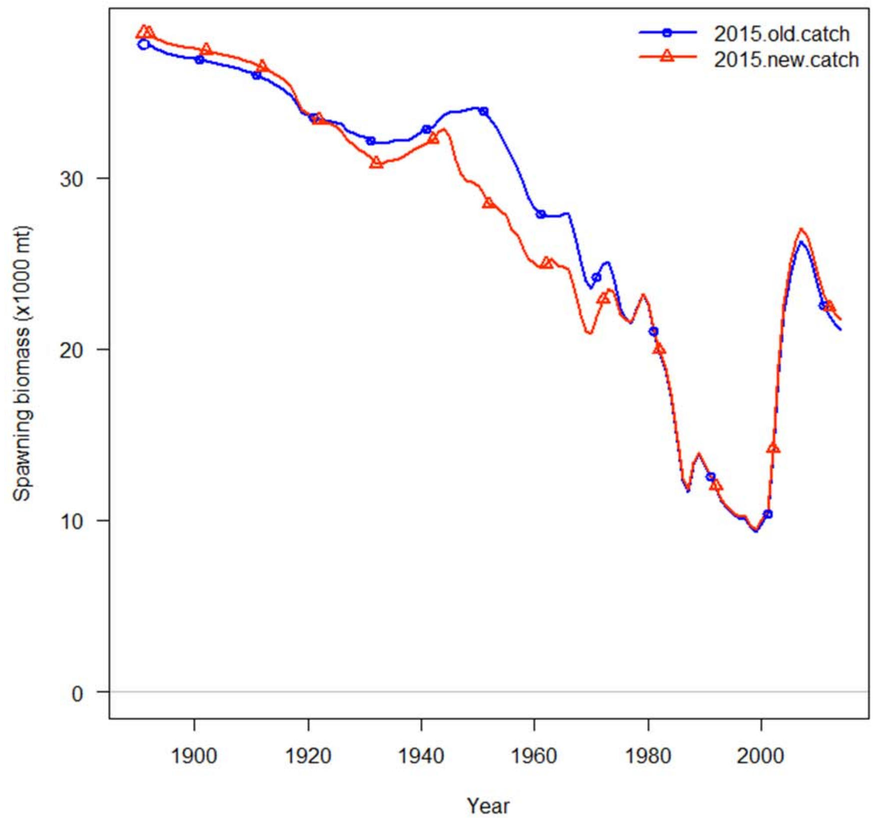


Figure 16. SS2 and SS3 versions of the 2007 model and data, with (top) and without (bottom) the time varying growth component of the model..



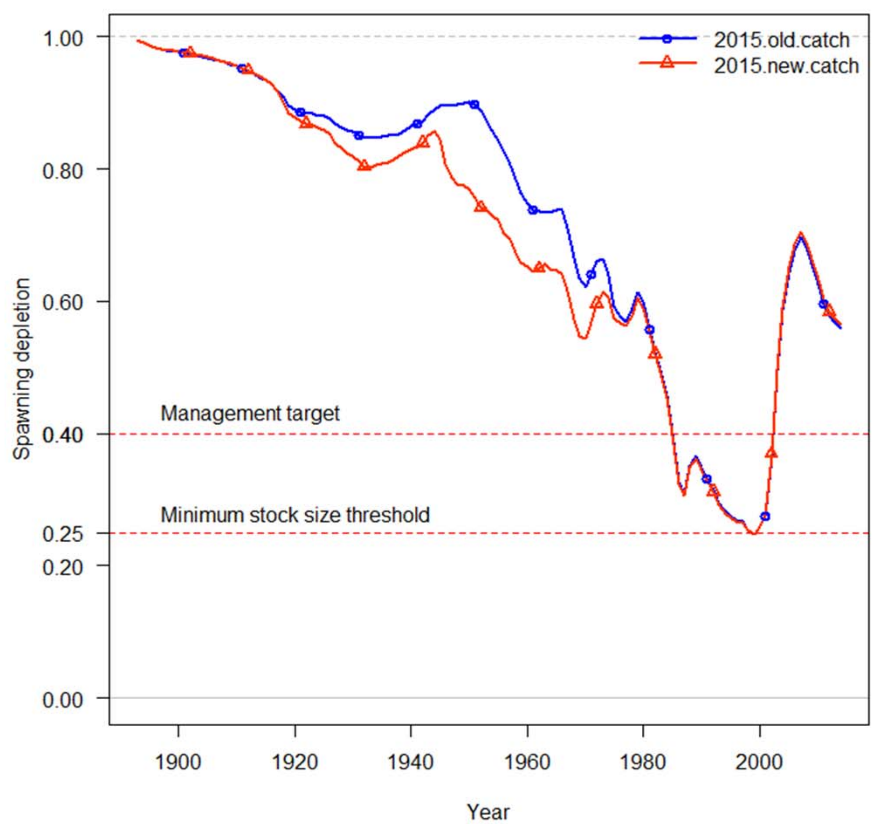
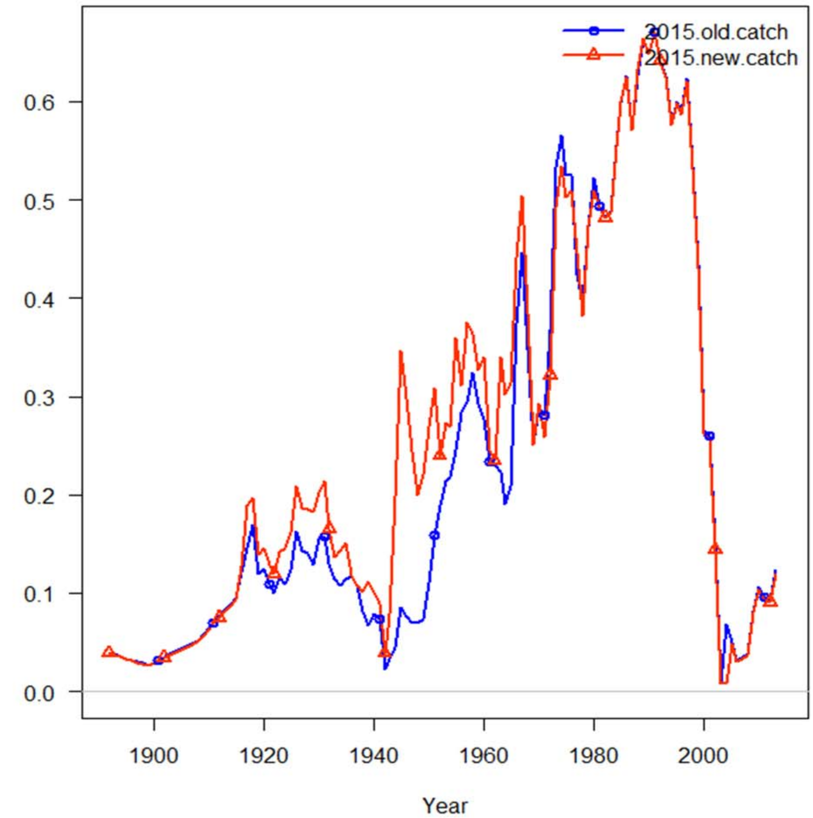


Figure 17a (top) and b (bottom): Model trajectories with the 2007 and with the 2015 catch time series..



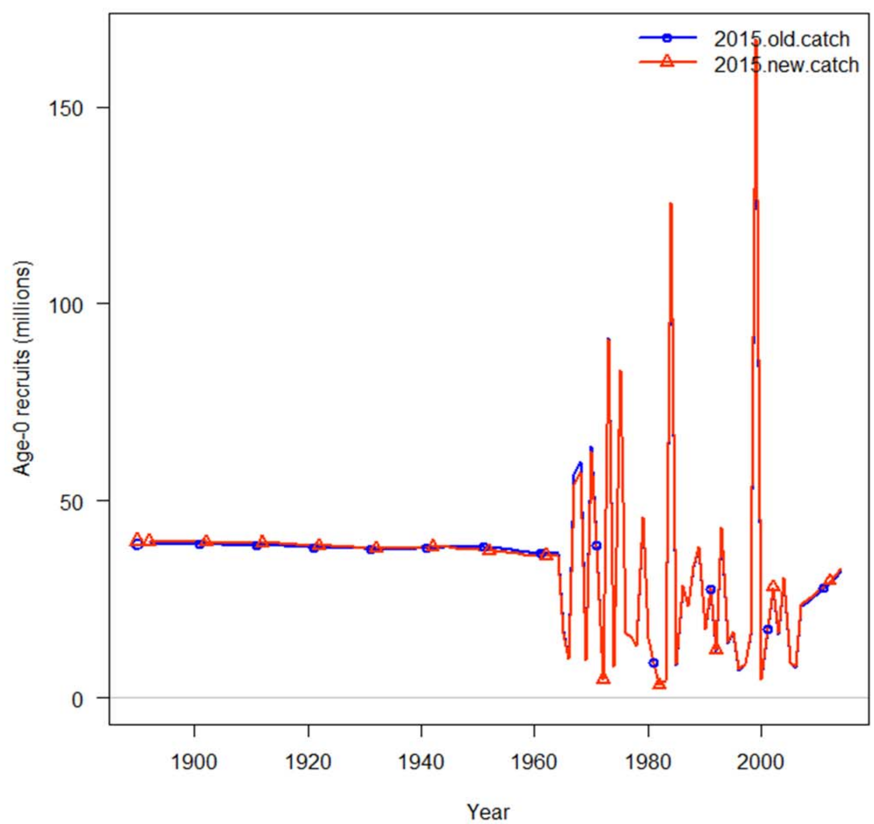
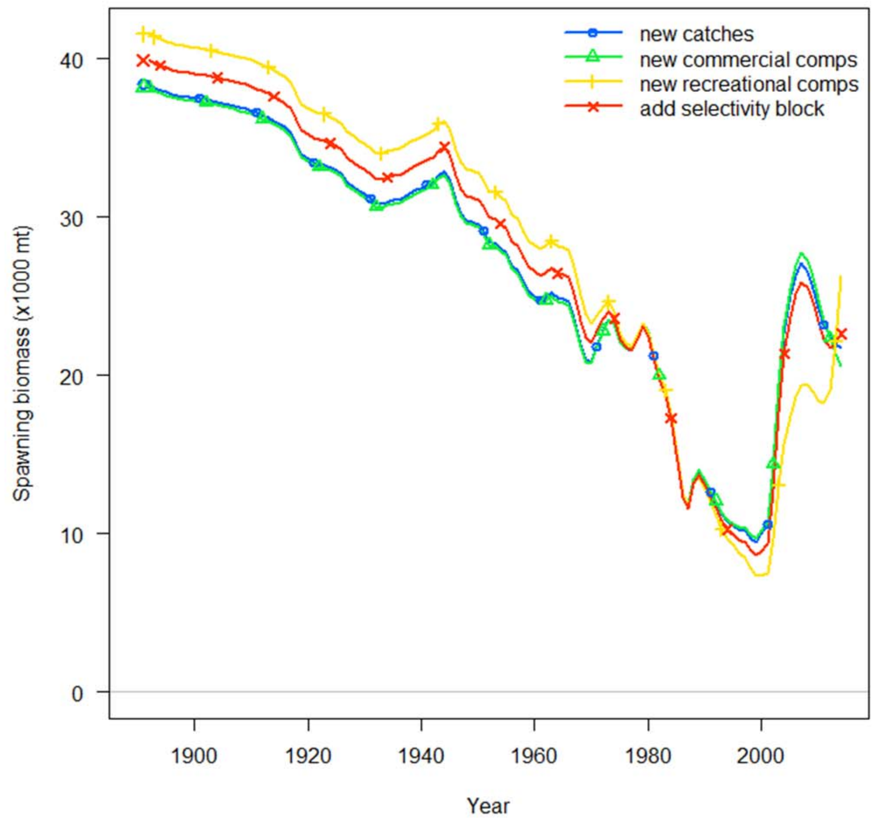


Figure 18a (top) and b (bottom): Estimates of exploitation rate and recruitmeent based on the 2007 and 2015 model catch histories..



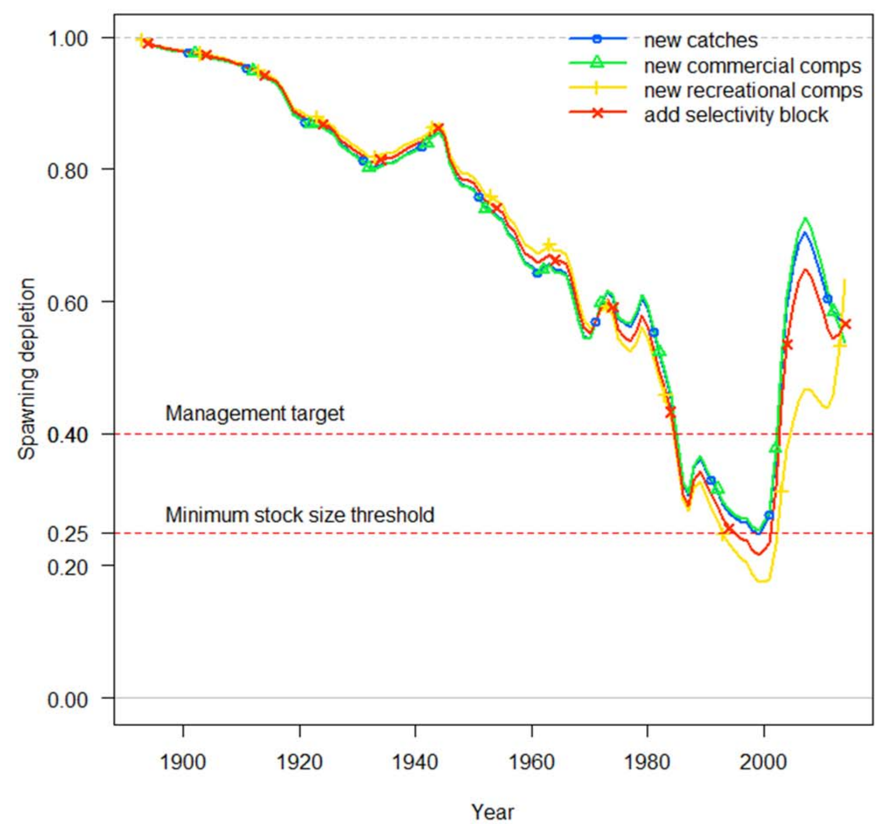


Figure 19a (top) and 1b (bottom): Estimated spawning biomass and spawning depletion level for base model when new commercial and recreational compositional data are sequentially added.

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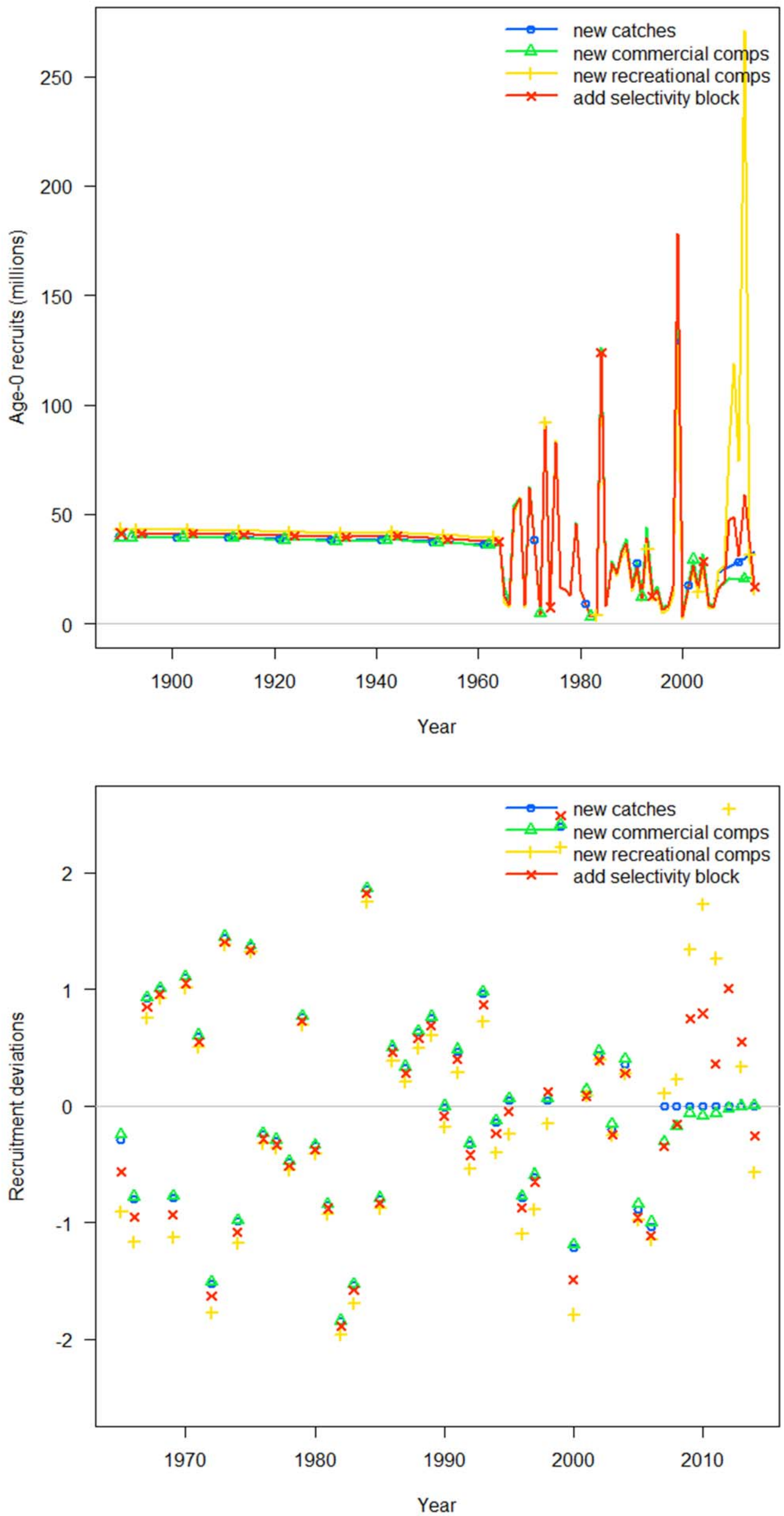
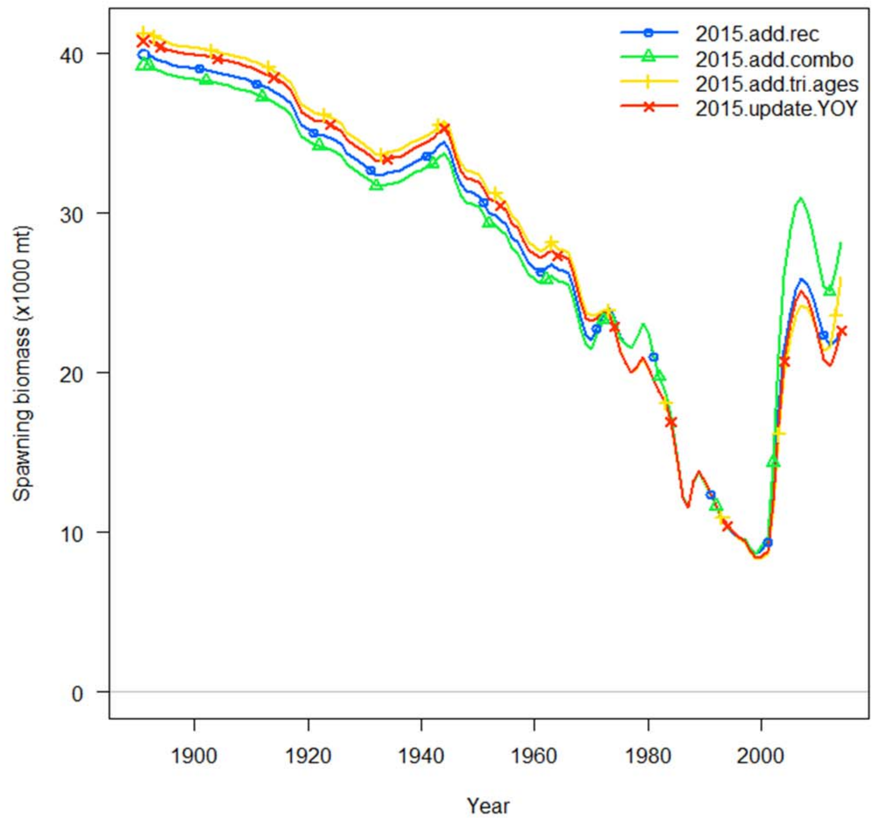


Figure 20a (top) and b (bottom): Estimated recruitments and recruitment deviations for base model when new commercial and recreational compositional data are sequentially added..



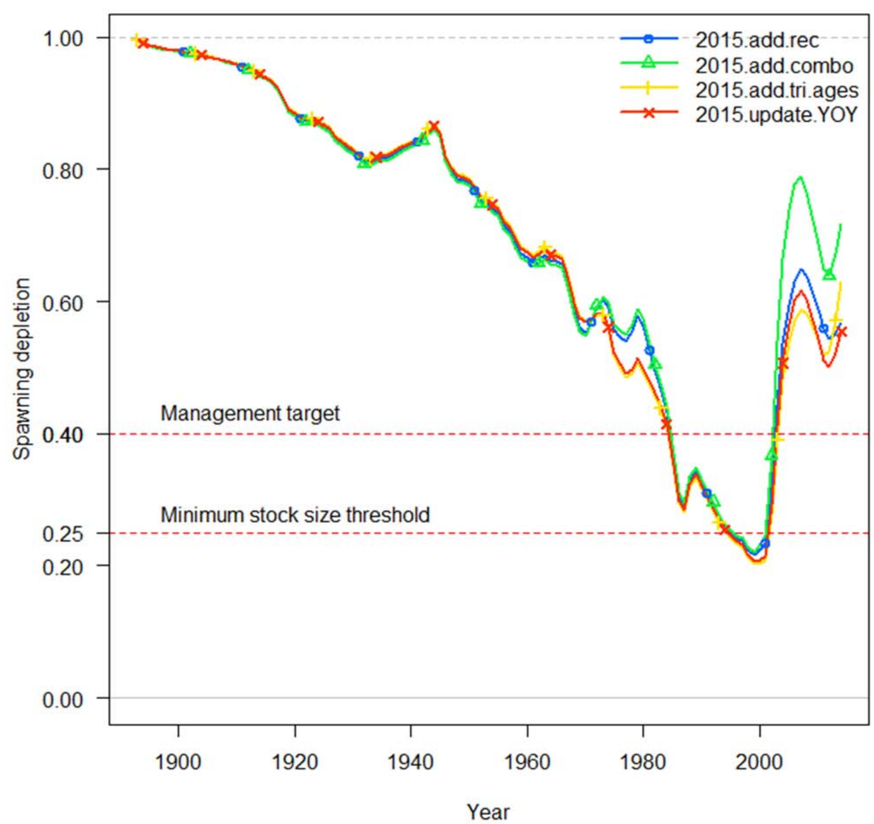


Figure 21a (top) and b (bottom): Estimated spawning biomass and spawning depletion level for base model when new survey data are sequentially added.

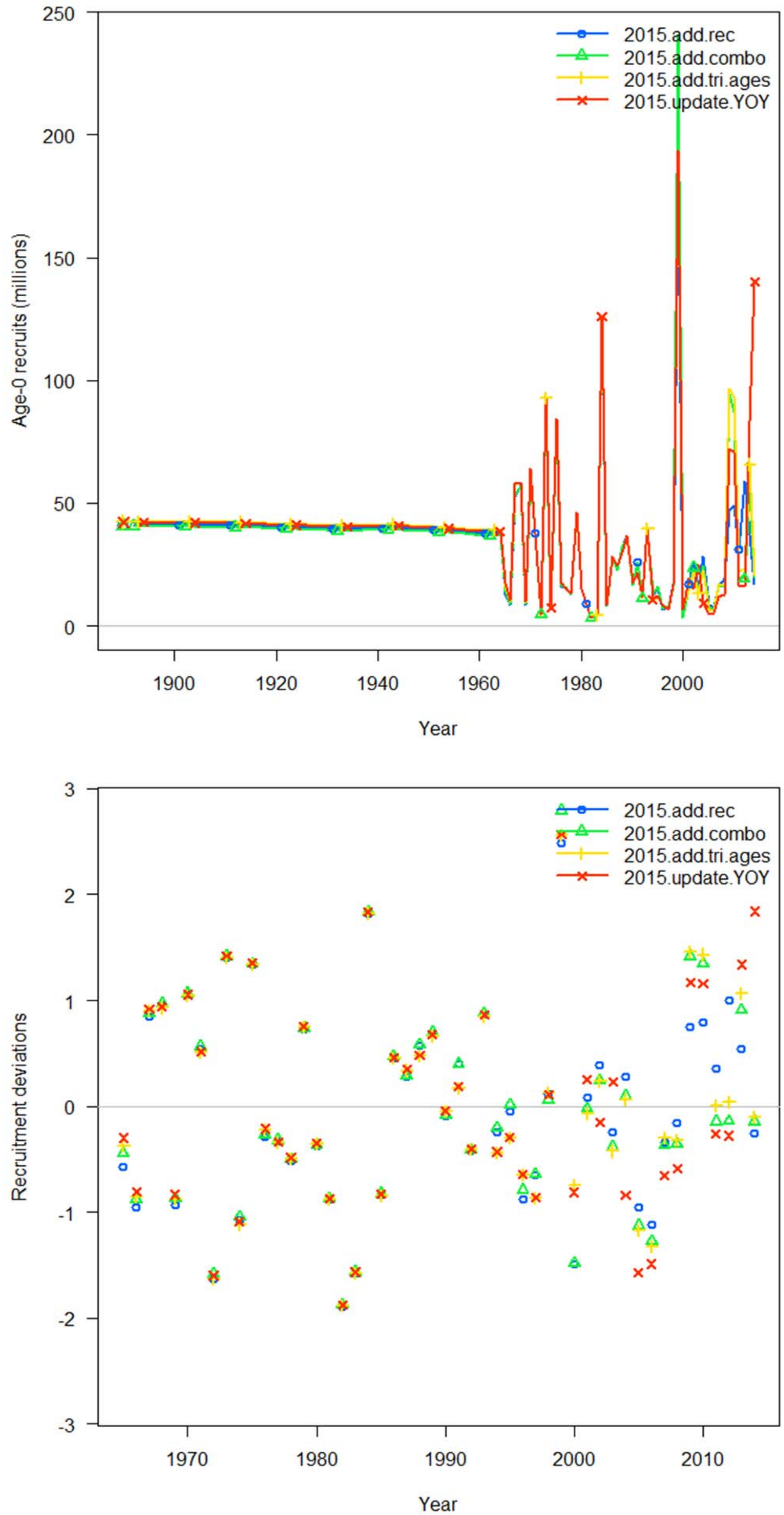
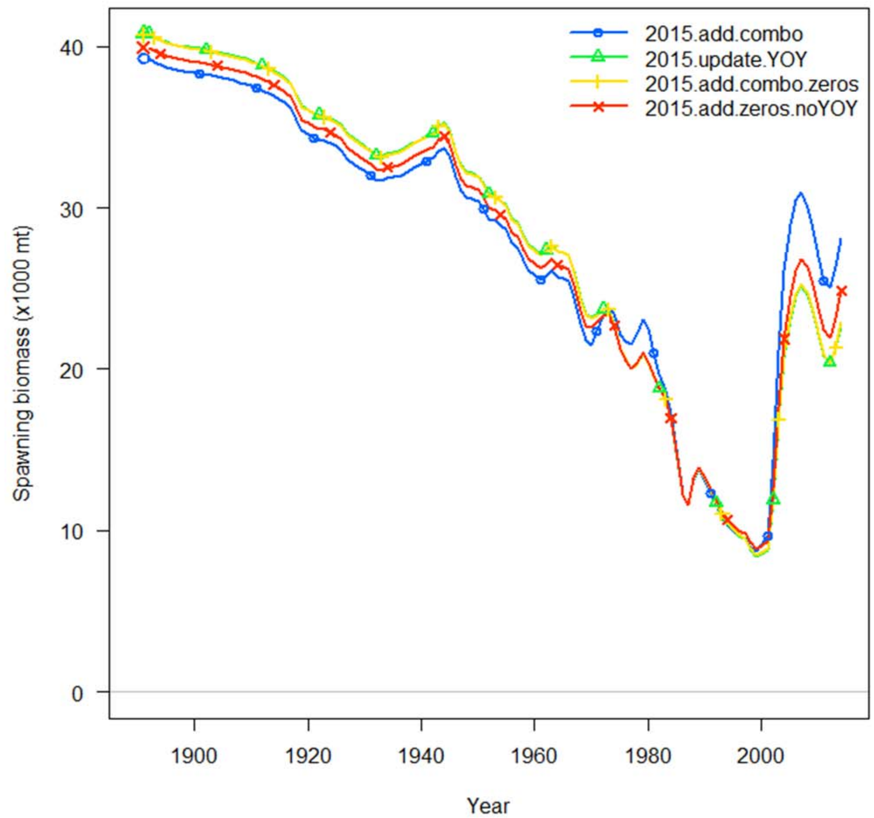


Figure 22a (top) and b (bottom): Estimated recruitments and recruitment deviations for base model when new survey data are sequentially added.



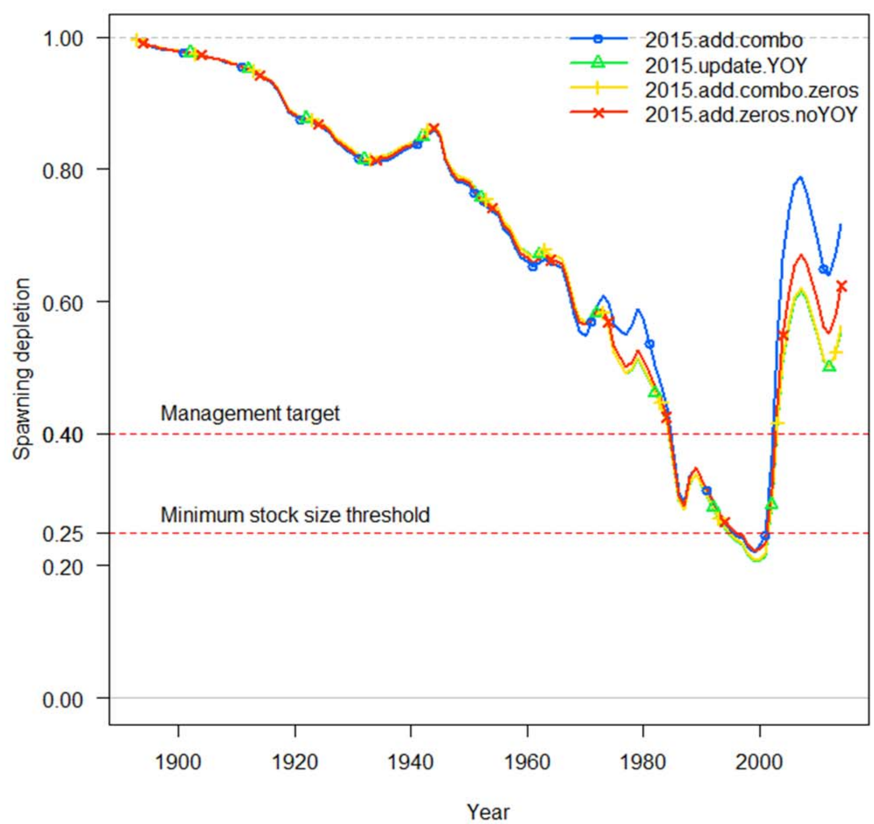


Figure 23a (top) and b (bottom): Sensitivity tests to interim base model to evaluate effect of adding age 0 age bins to include survey age 0 catches, with and without inclusion o f the juvenile abundance index.

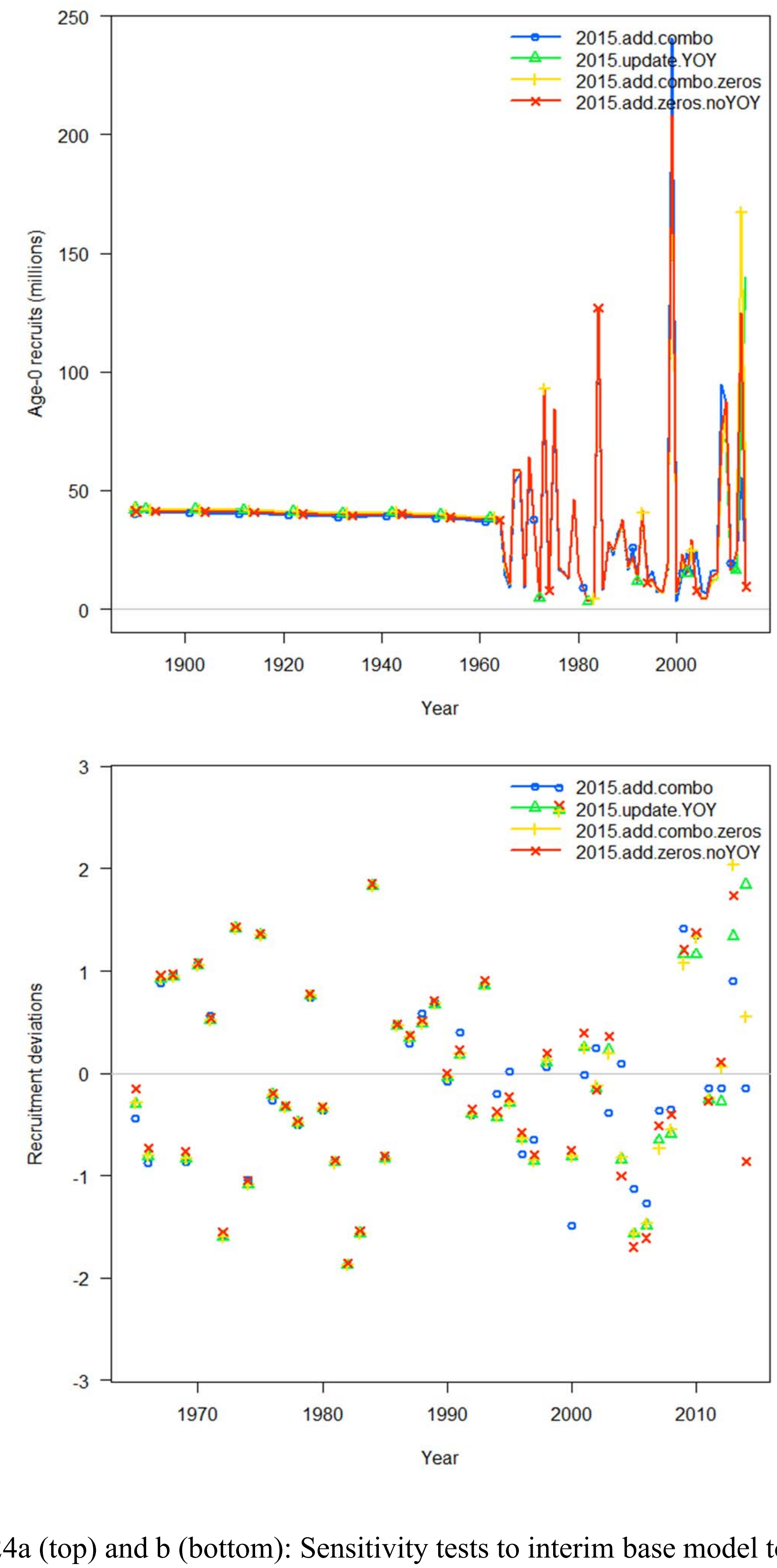


Figure 24a (top) and b (bottom): Sensitivity tests to interim base model to evaluate effect of adding age 0 age bins to include survey age 0 catches, with and without inclusion o f the juvenile abundance index.

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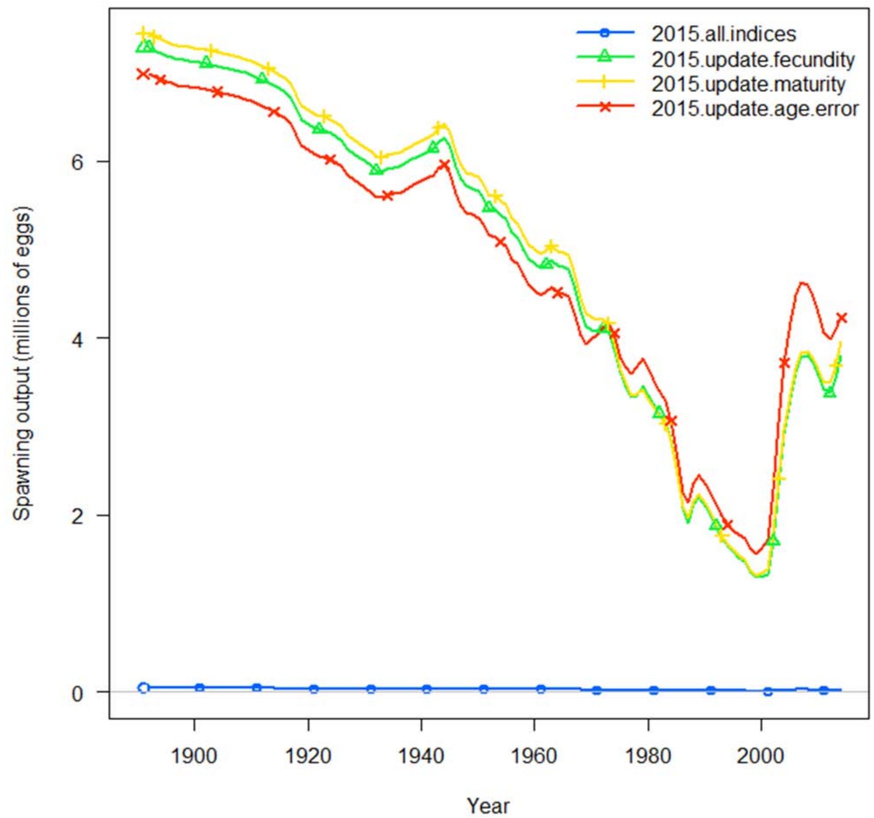

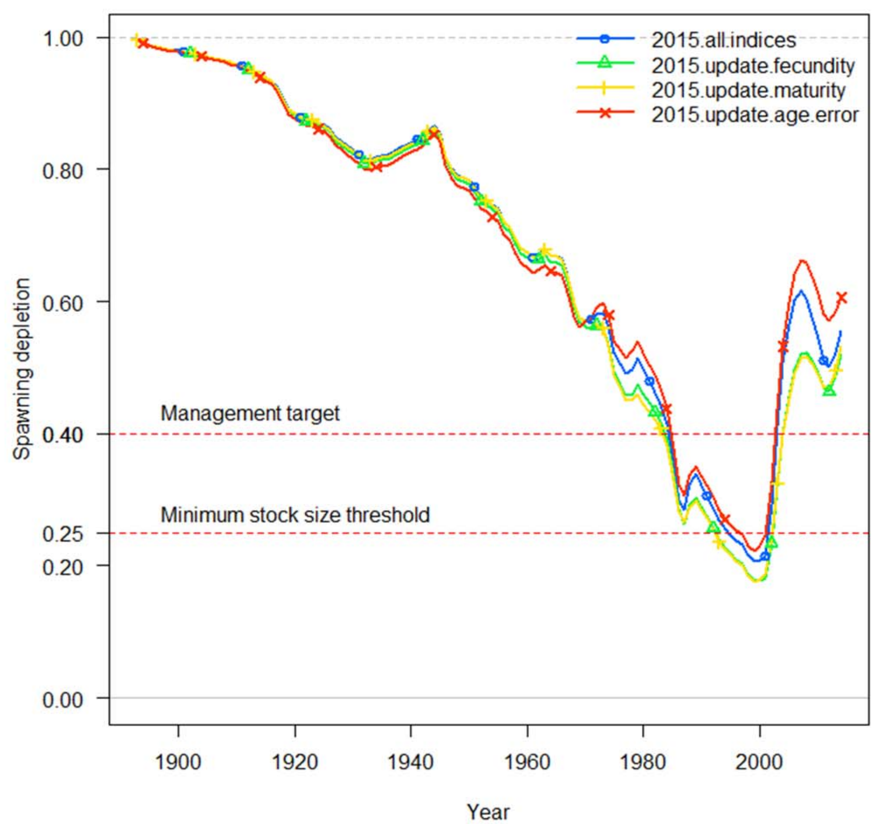

Figure 25a (top) and b (bottom): Estimated spawning biomass (larval output) and spawning depletion level for base model when new life history data are sequentially added (note that the flat blue line in 24a reflects spawning biomass before fecundity added to account for larval production).

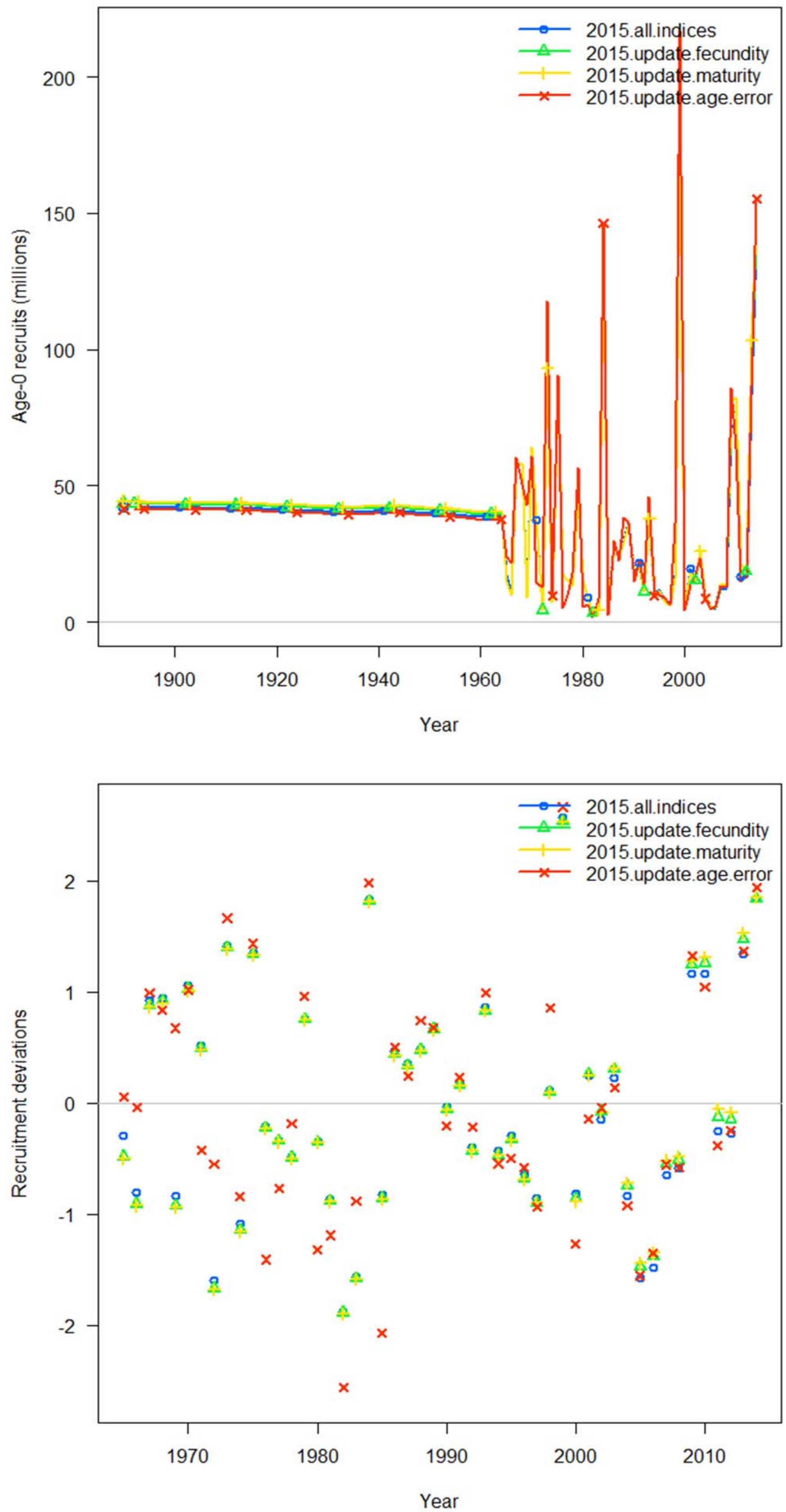

Figure 26a (top) and b (bottom): Estimated recruitments and recruitment deviations for base model when new life history data are sequentially added.

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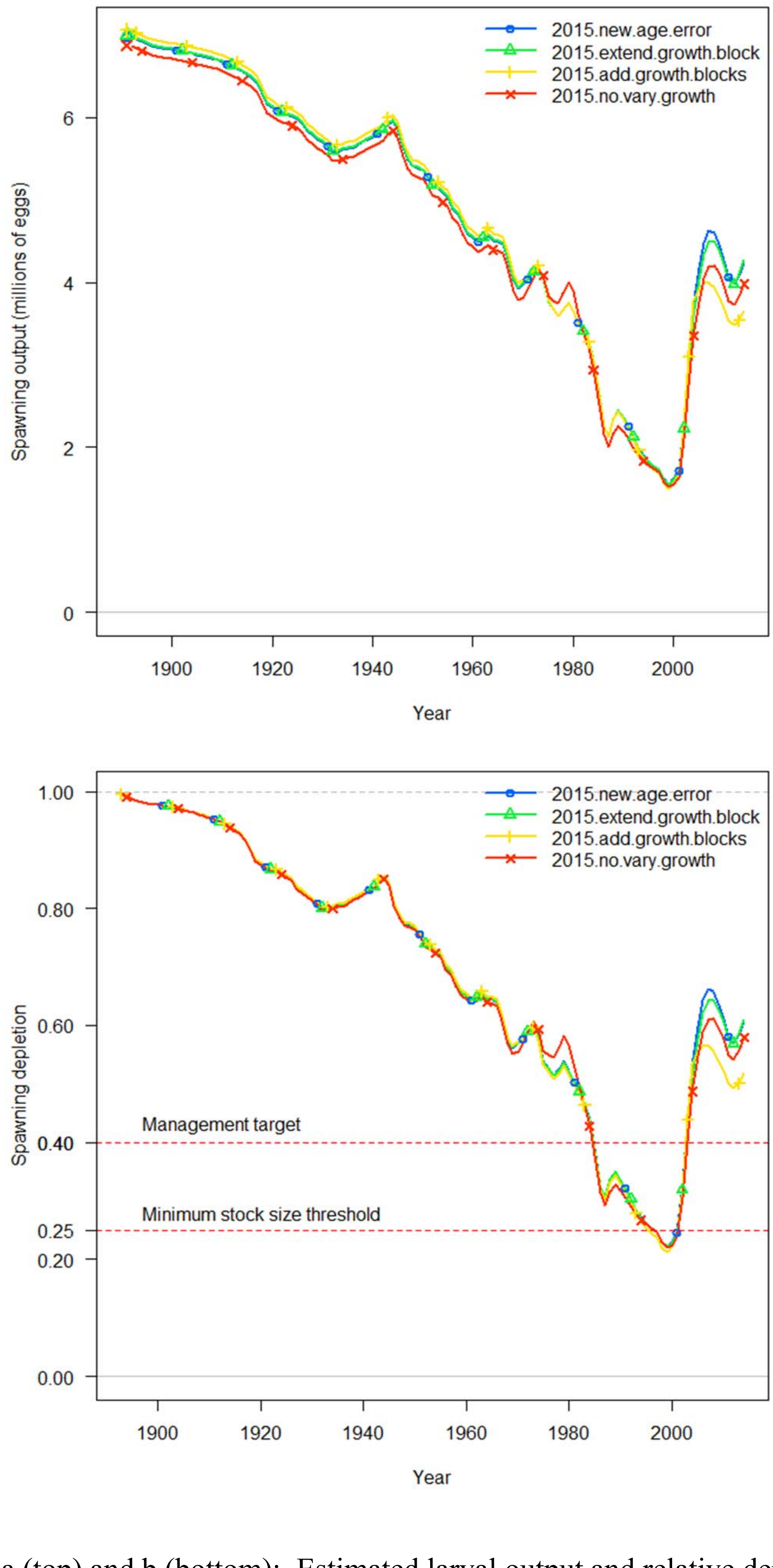
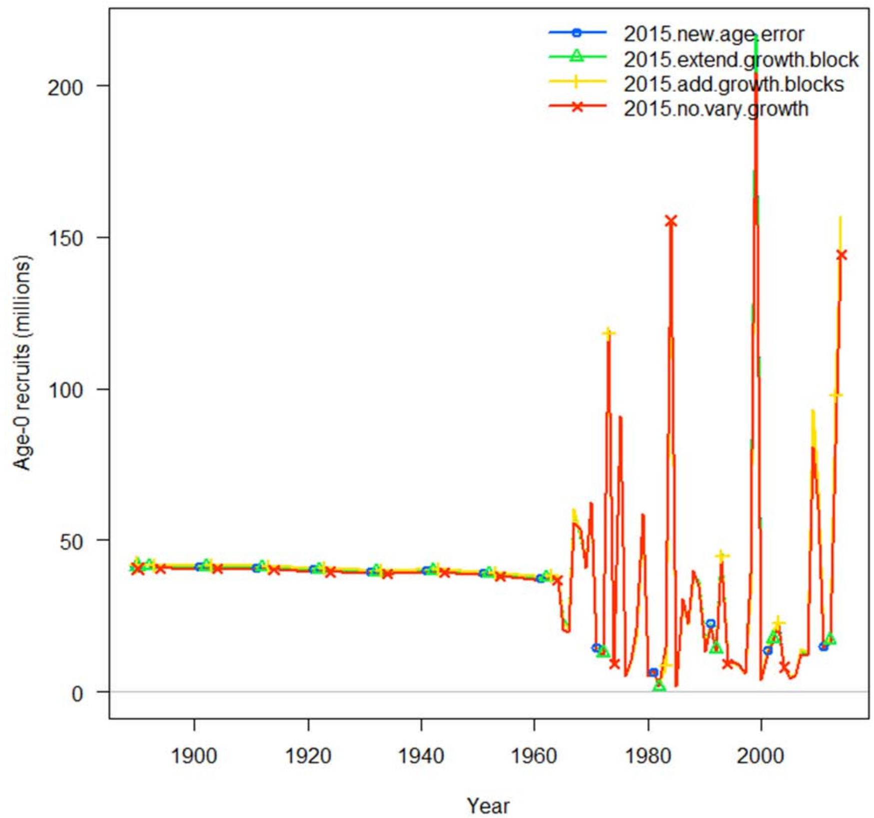


Figure 27a (top) and b (bottom): Estimated larval output and relative depletion for base model when alternative means of estimating growth are explored as a sensitivity test.



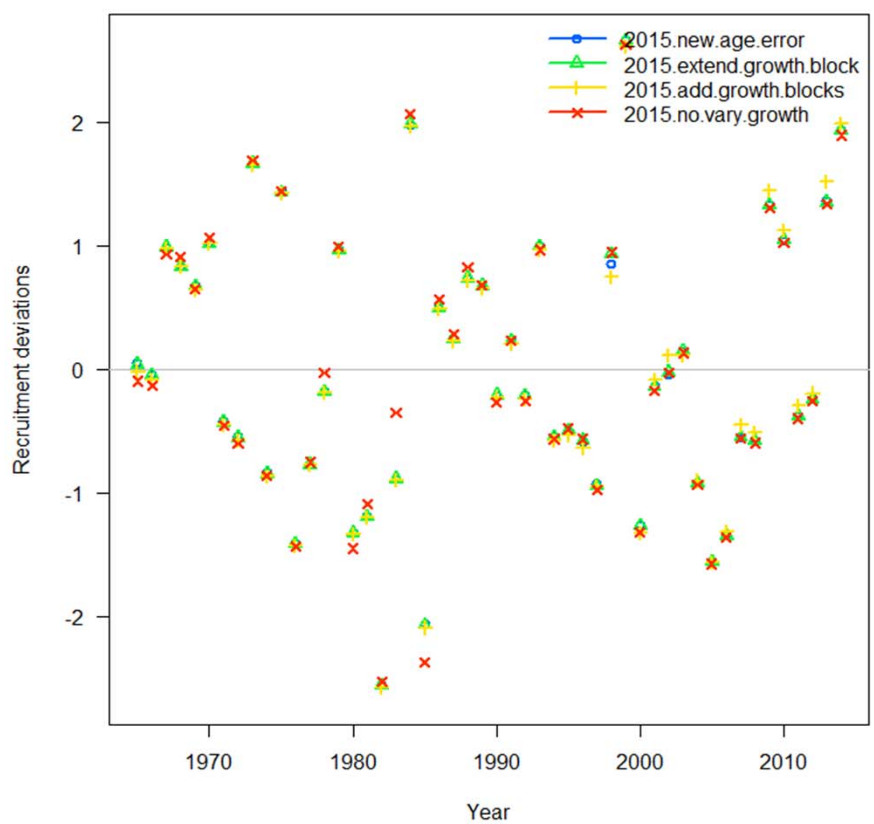
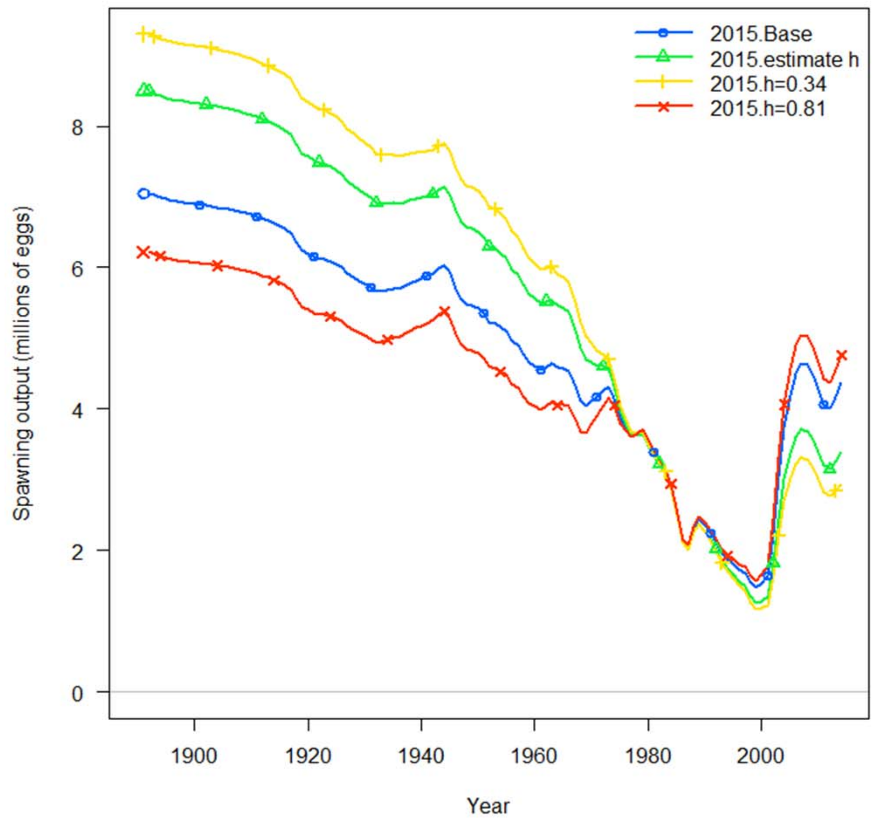


Figure 28a (top) and b (bottom): Estimated recruitments and recruitment deviations for base model when alternative means of estimating growth are explored as a sensitivity test.



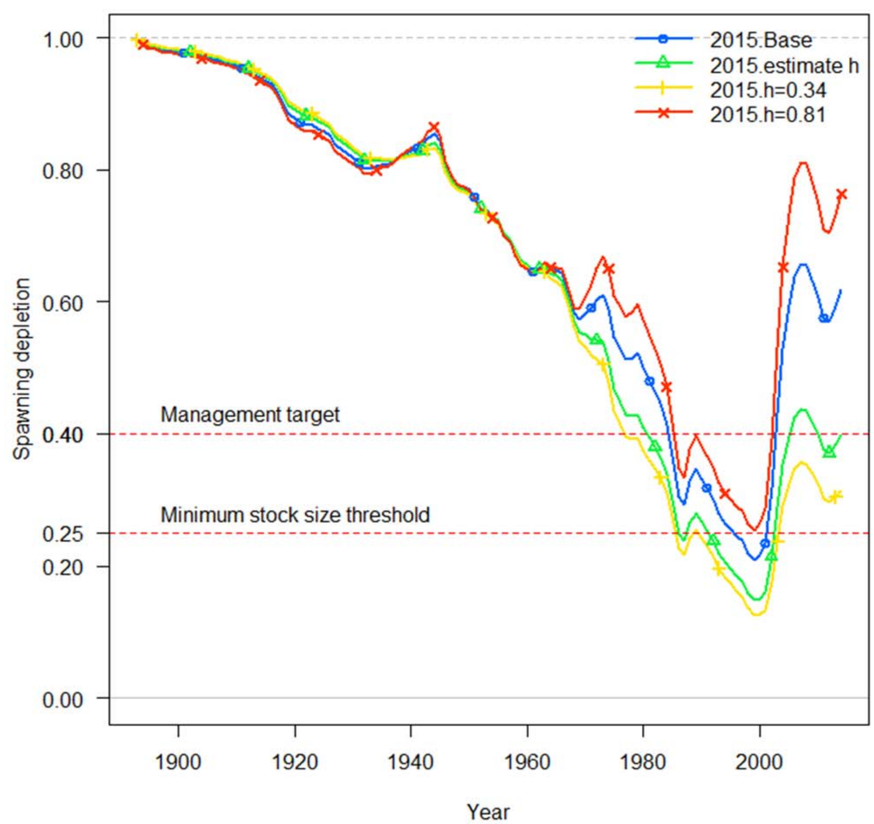


Figure 29a (top) and b (bottom): Estimated larval output and relative depletion for base model when alternative steepness values are applied.

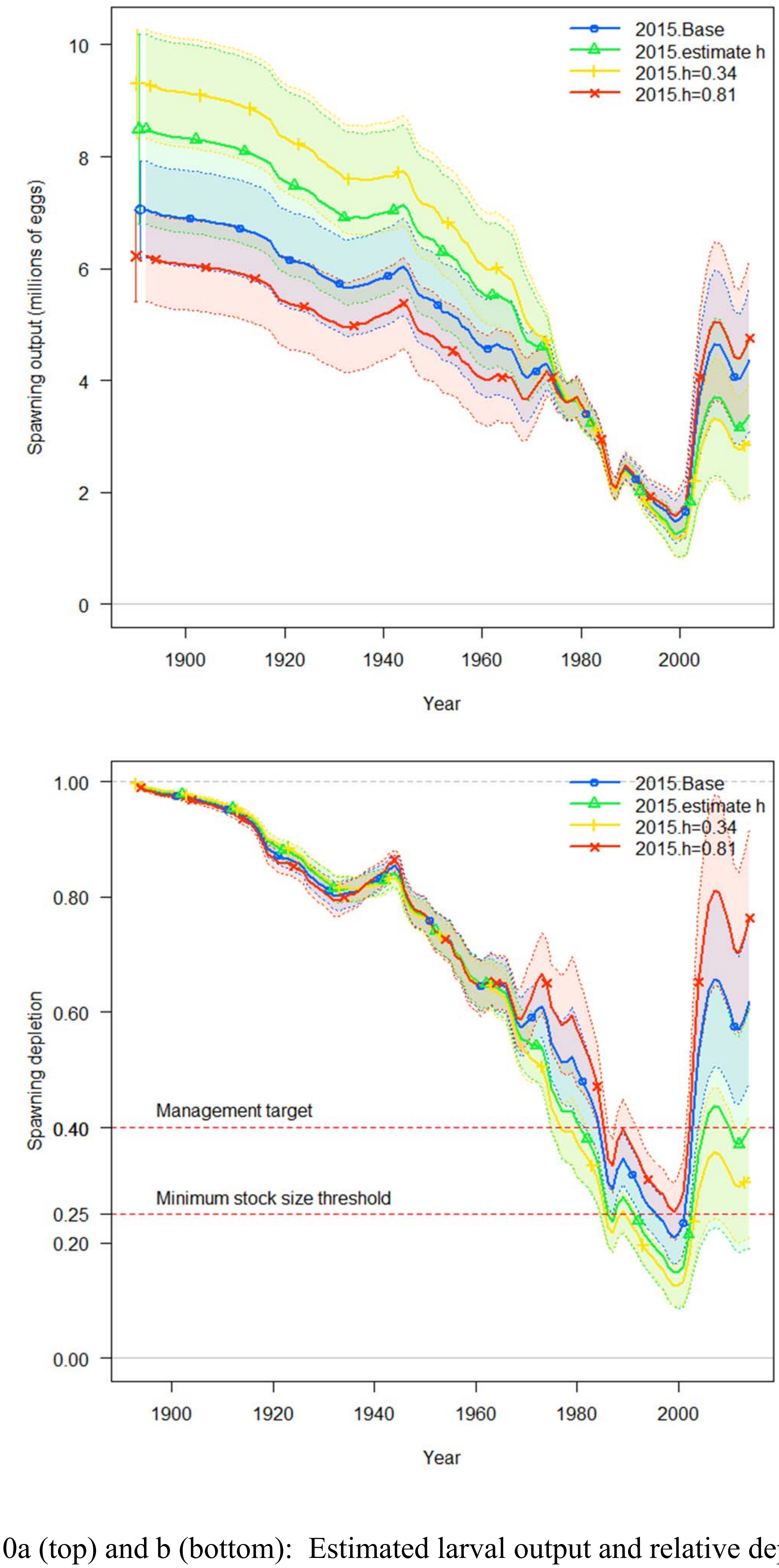
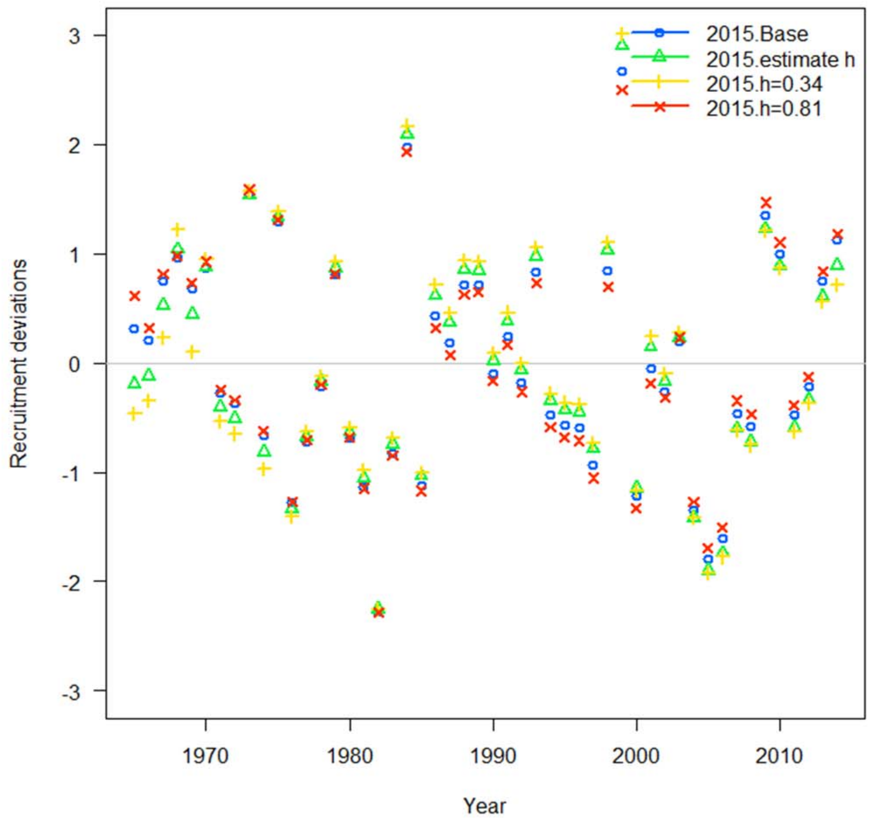


Figure 30a (top) and b (bottom): Estimated larval output and relative depletion for base model when alternative steepness estimates are applied, including approximate 95% confidence limits.



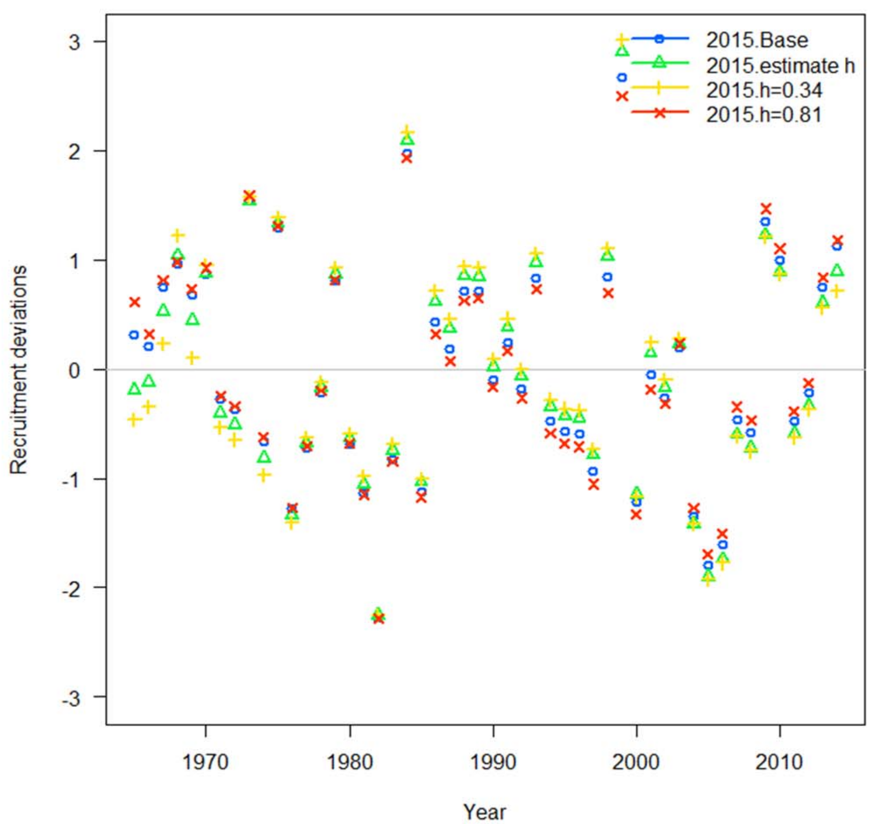


Figure 31a (top) and b (bottom): Estimated recruitments and recruitment deviations for base model when alternative steepness values are applied.

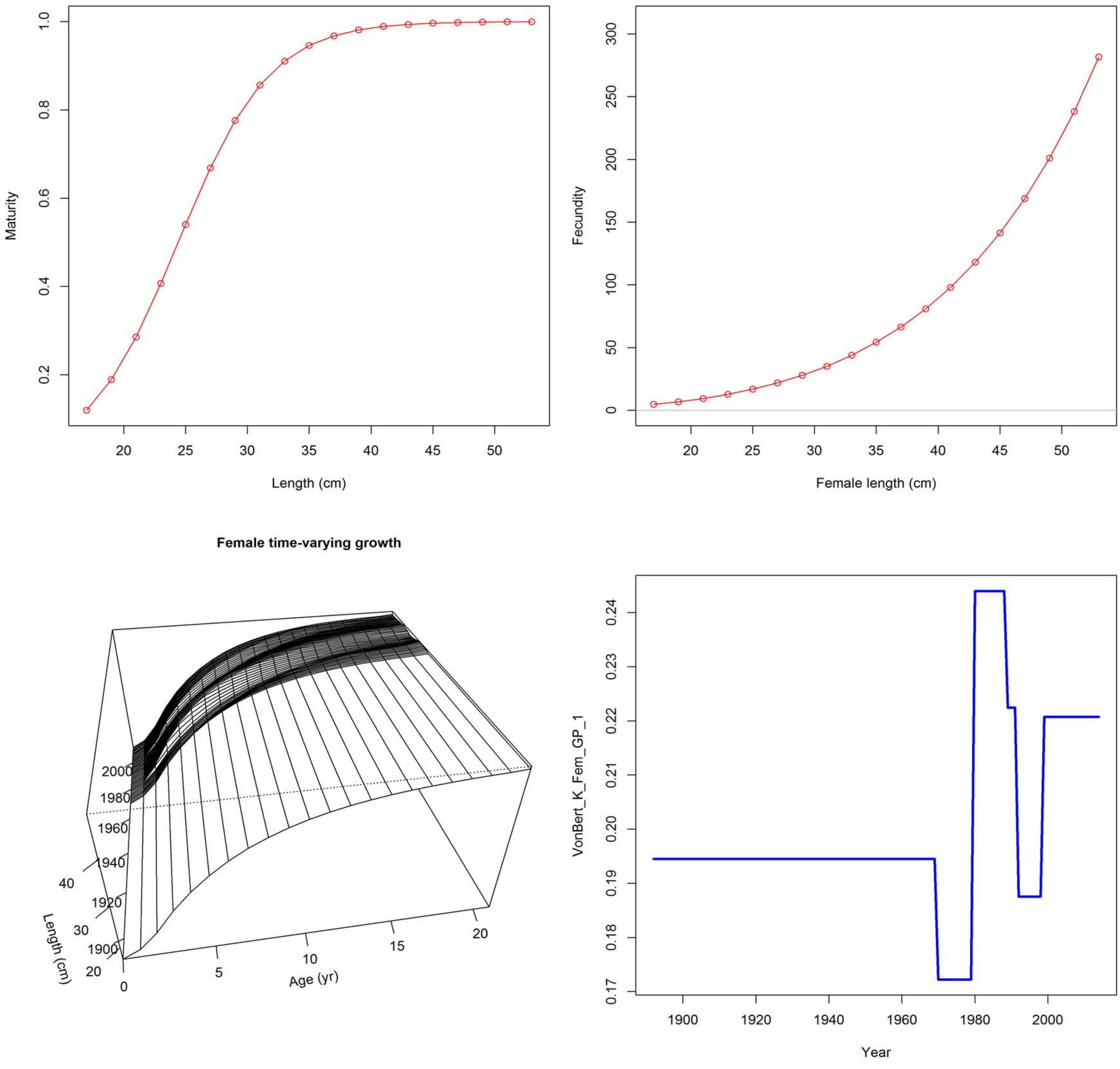


Figure 32a-d: Maturity, fecundity,and time varying growth estimates in the base model (reflect new estimates of these relationships).

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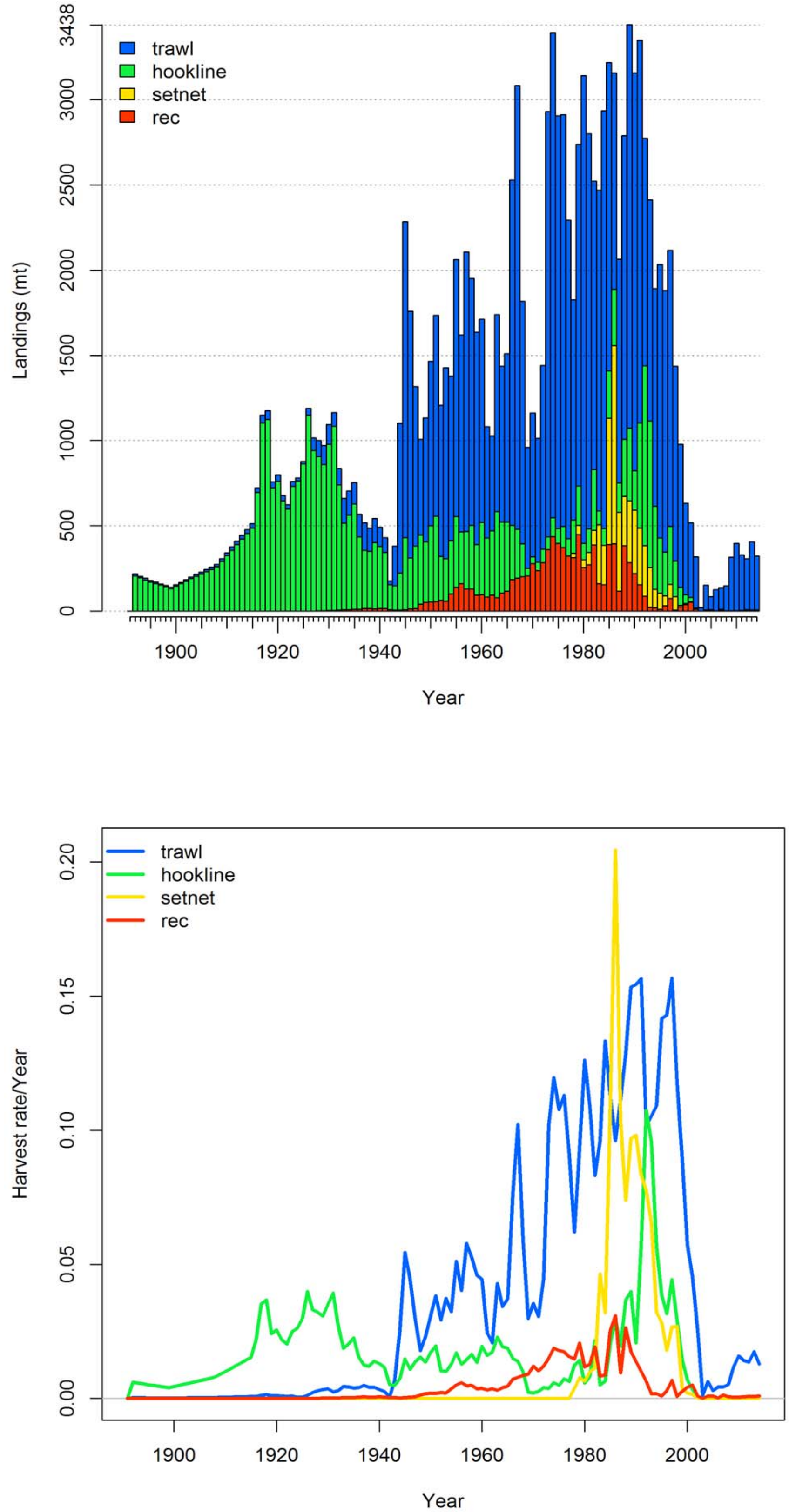

Figure 33a (top) and b (bottom): Total catches and fishery-specific relative exploitation rates in the base model.

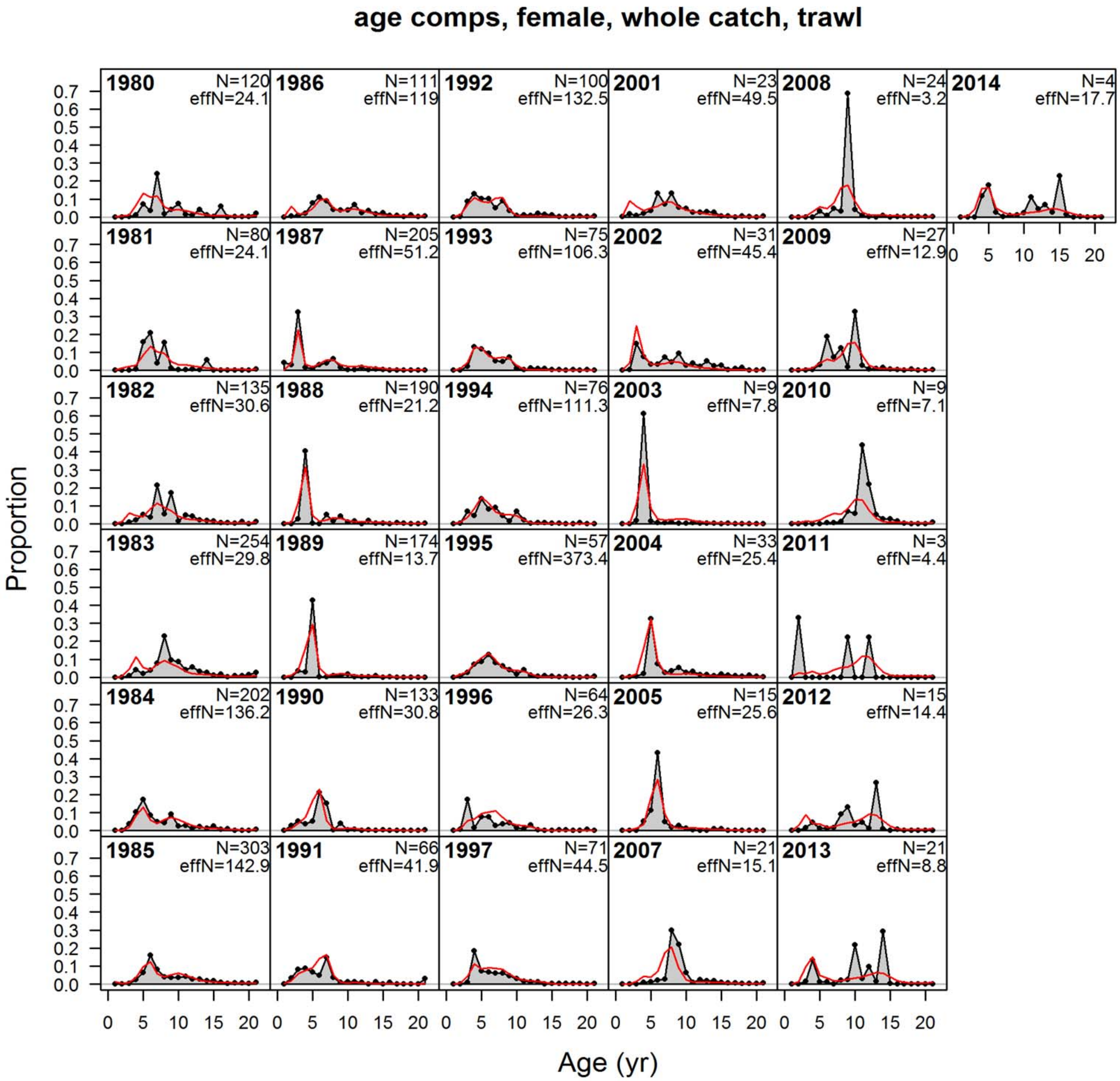

Figure 34: Fits to female length composition data from the trawl fishery, including new length composition data for the 2007-2014 period.

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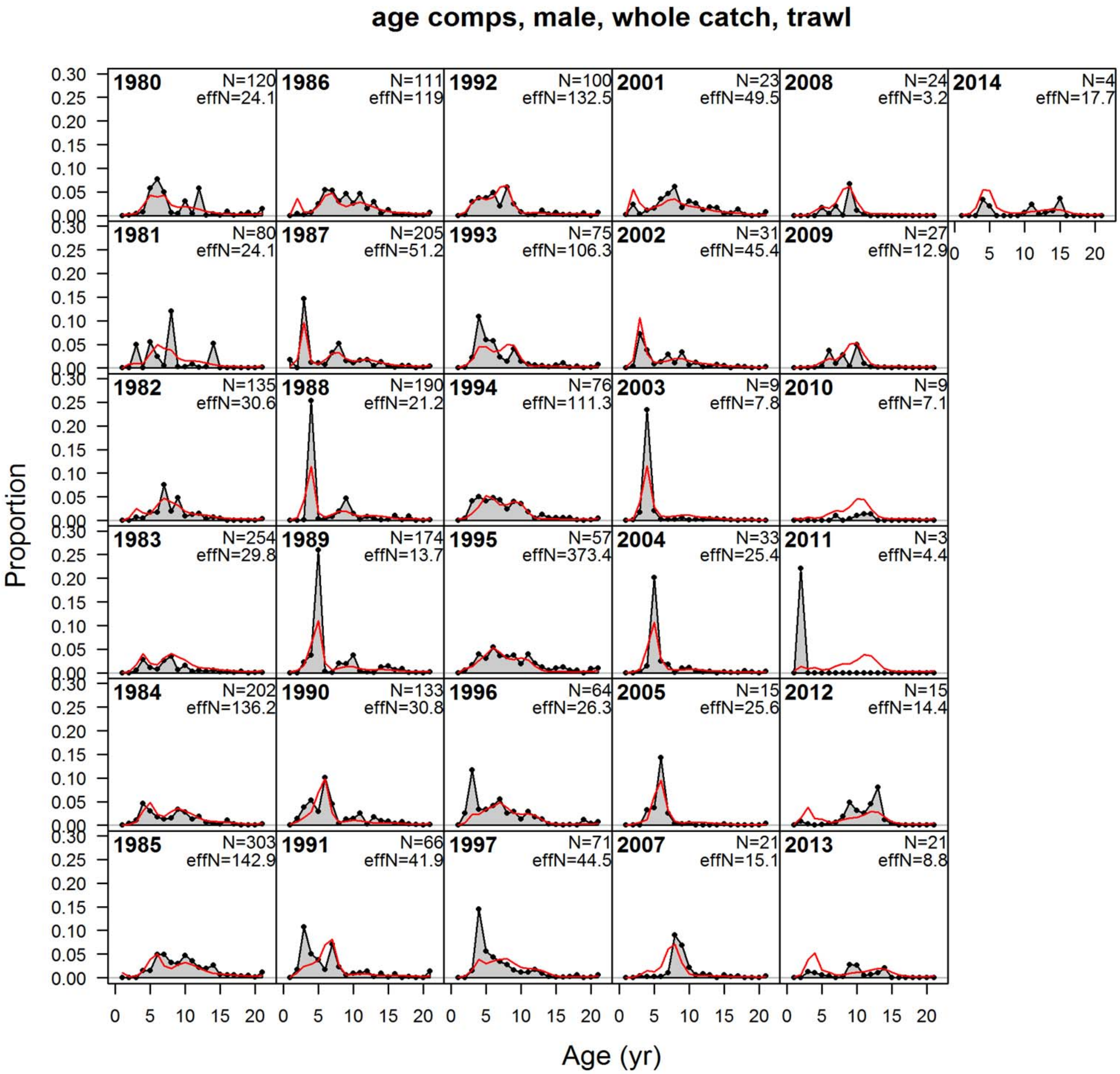

Figure 35: Fits to male length composition data from the trawl fishery, including new length composition data for the 2007-2014 period.

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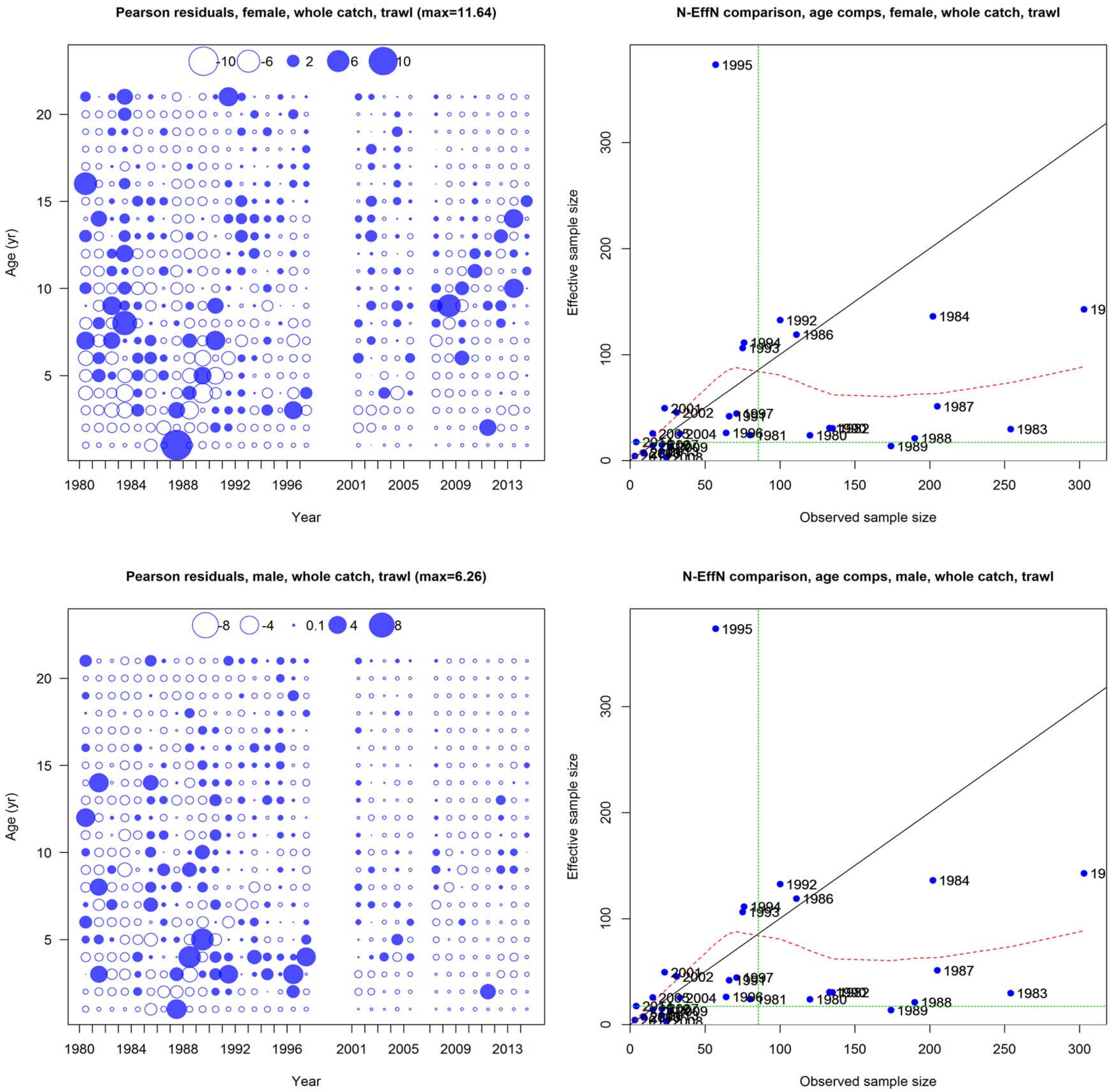

Figure 36a-d: Residuals and effective sample size comparisons associated with the fits to female length composition data from the trawl fishery.

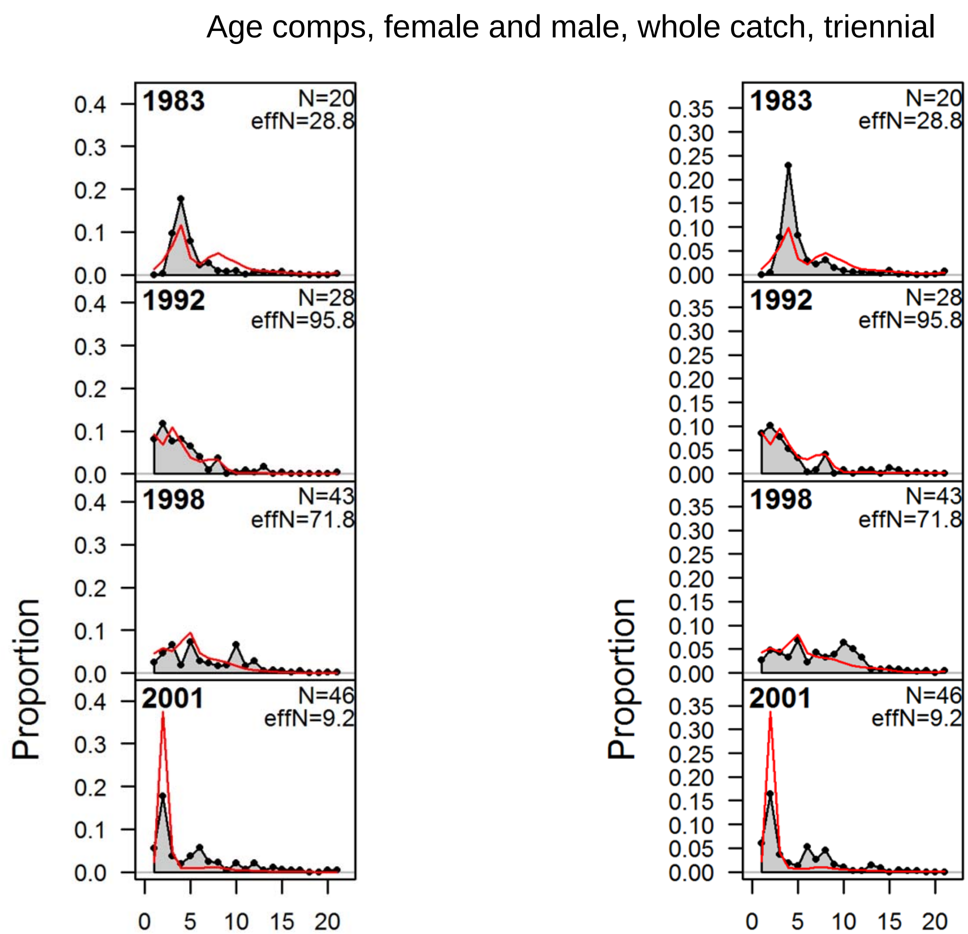

Figure 37a (left) and b (right): Fits to new age composition data from the triennial trawl survey

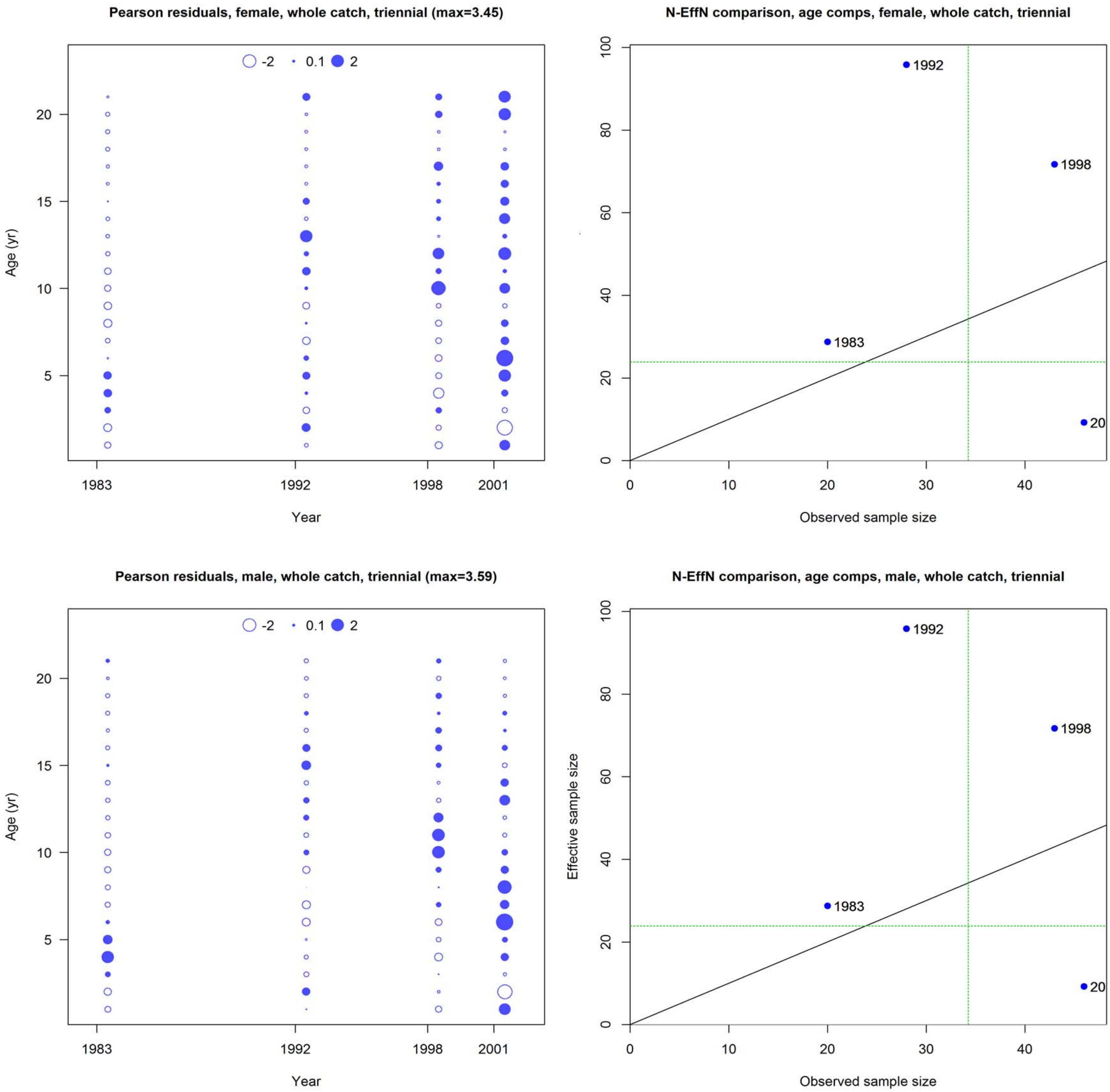

Figure 38a-d Residuals and effective sample size comparisons associated with the fits to female length composition data from the trawl fishery.

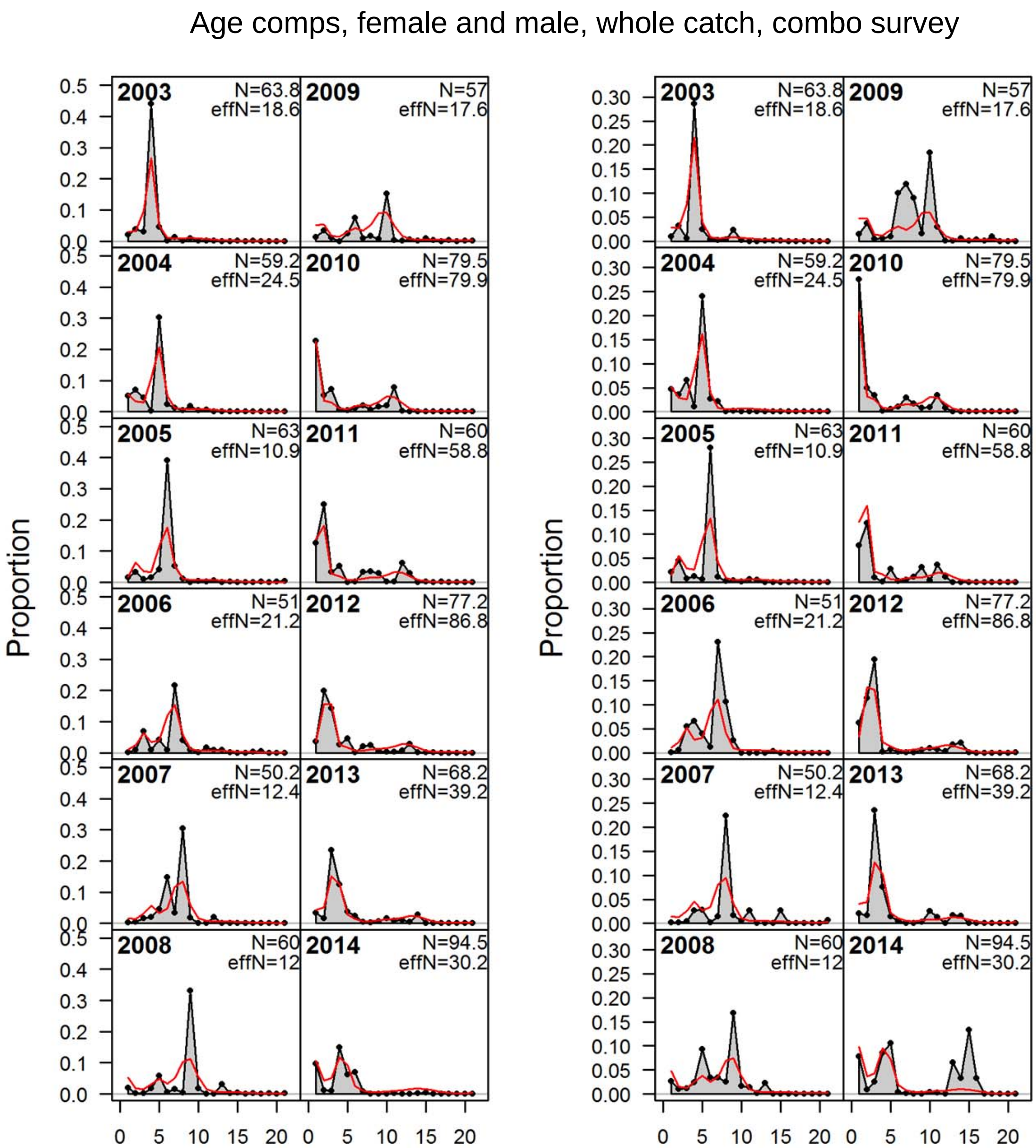

Figure 39a (top) and 1b (bottom): Observed and predicted age composition data from the NWFSC bottom trawl survey.

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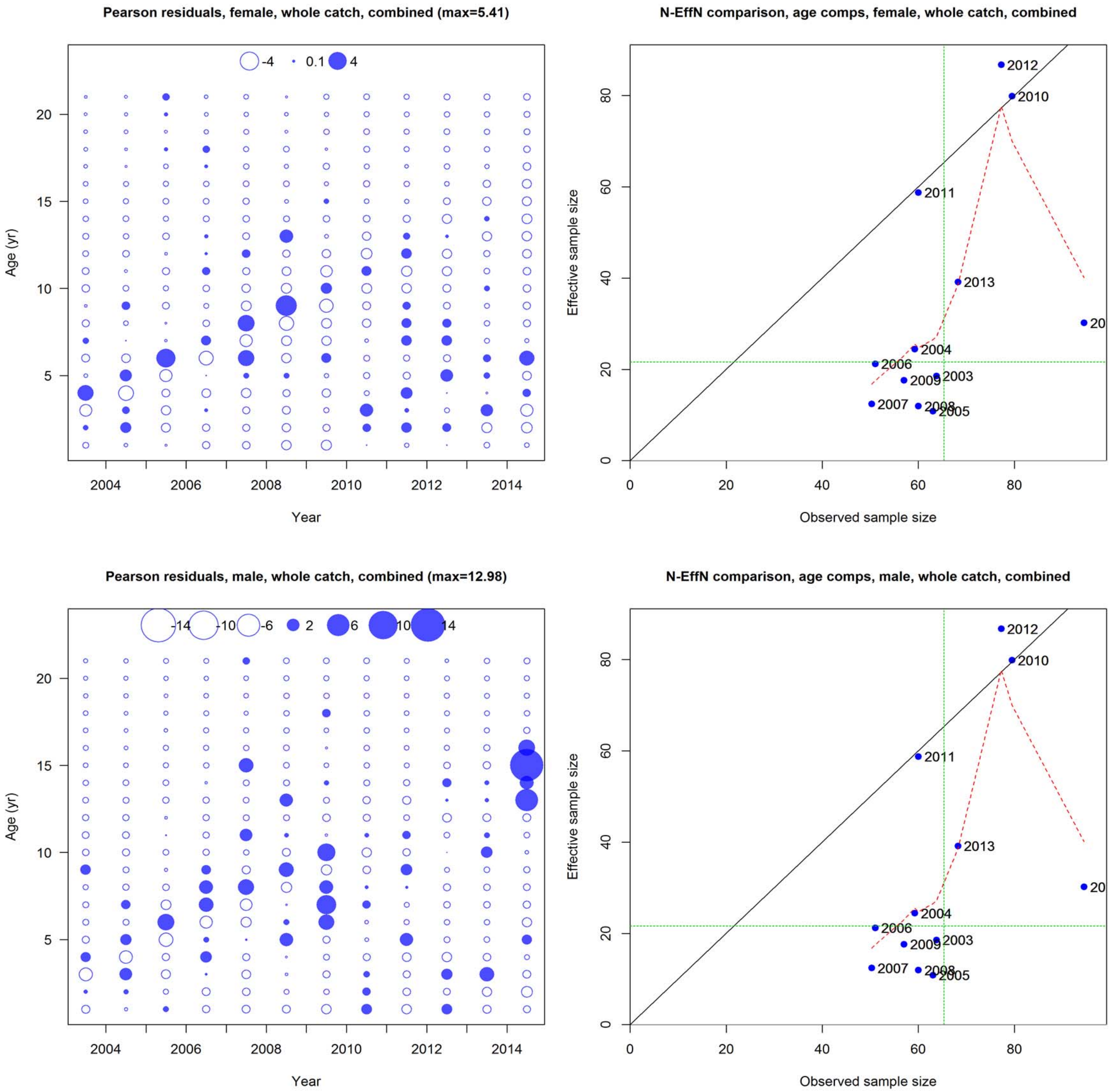


Figure 40a (top) and 1b (bottom): Residuals and effective sample size comparisons associated with the fits to age composition data from the NWFSC bottom trawl survey

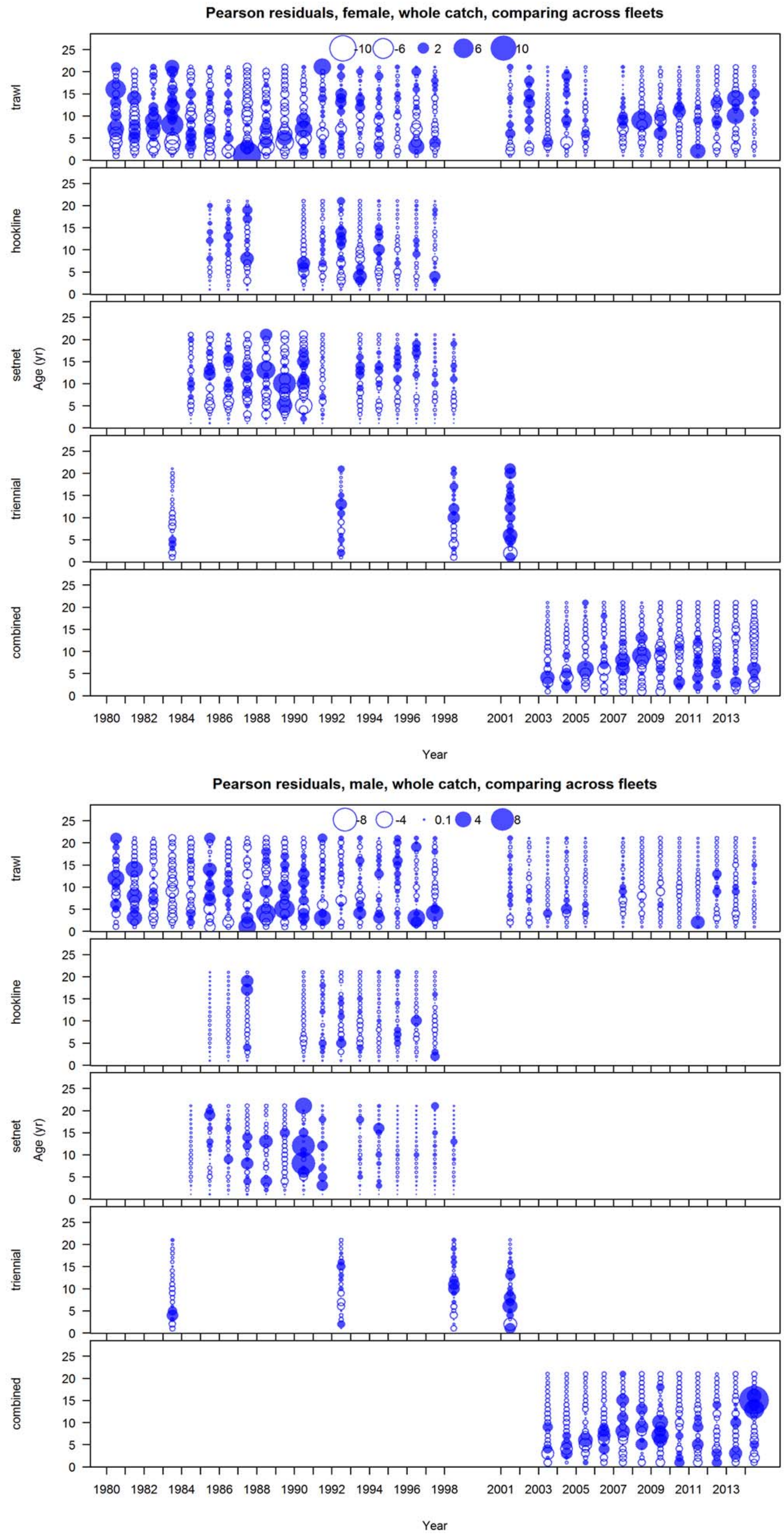
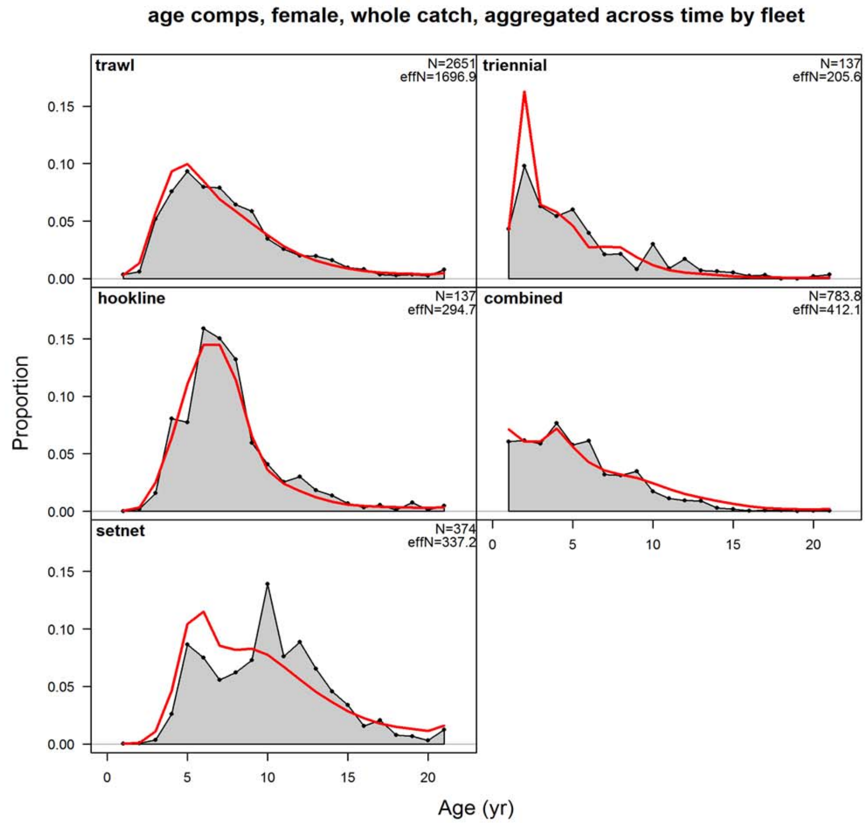


Figure 41a (top) and 1b (bottom): Residuals and effective sample size comparisons associated with the fits to female length composition data from the trawl fishery.



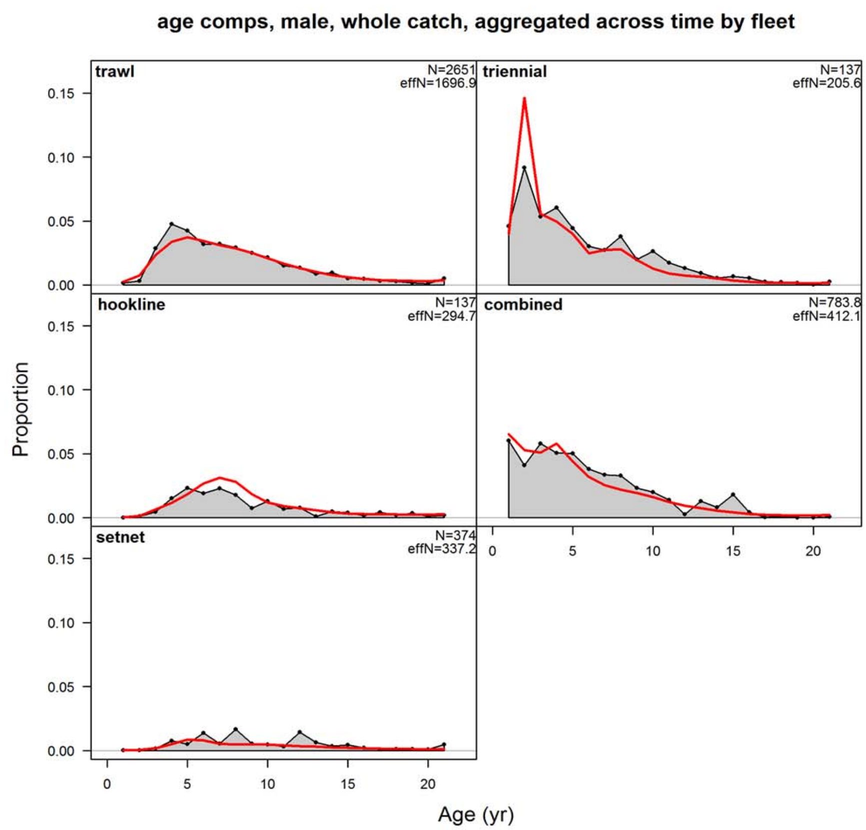


Figure 42a (top) and 1b (bottom): Estimated recruitments and recruitment deviations for base model when new survey data are sequentially added.

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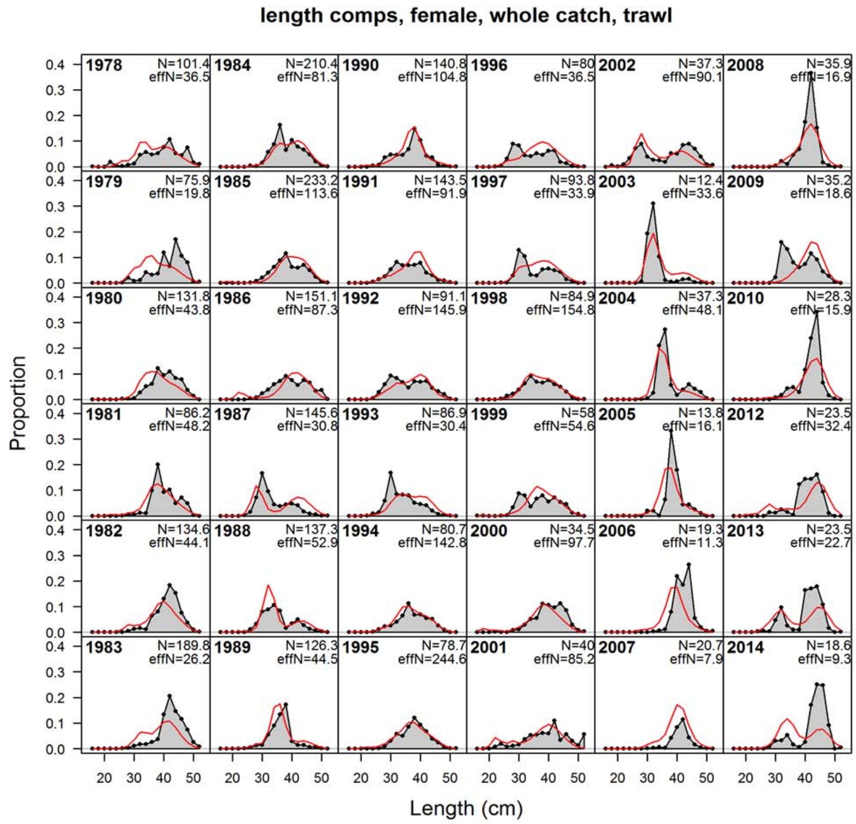

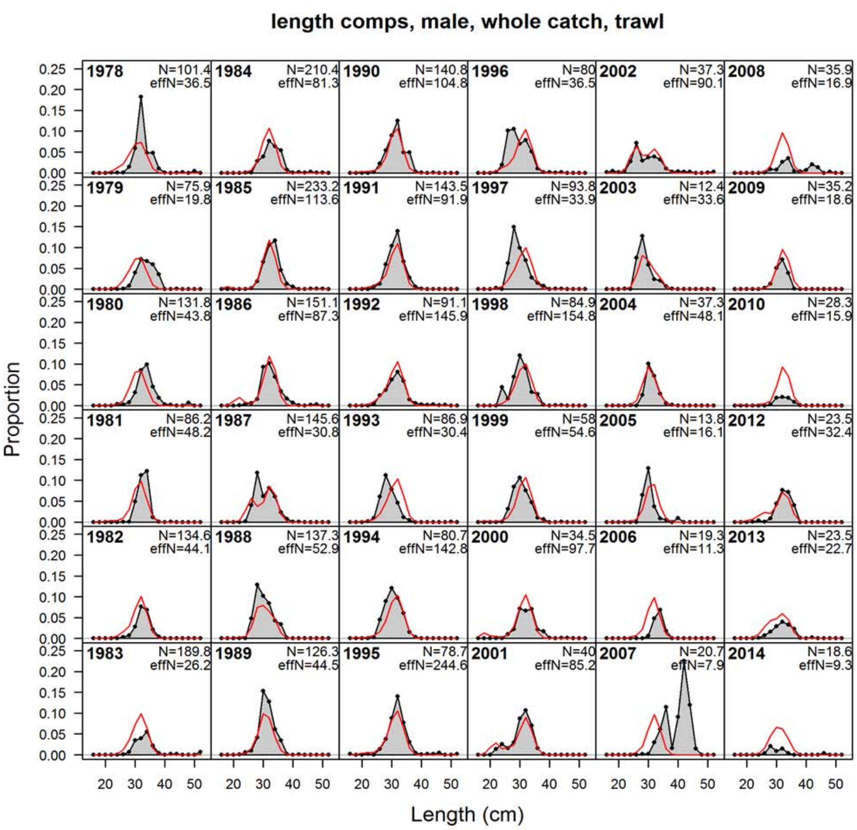

Figure 43a (top) and 1b (bottom): Estimated recruitments and recruitment deviations for base model when new survey data are sequentially added.

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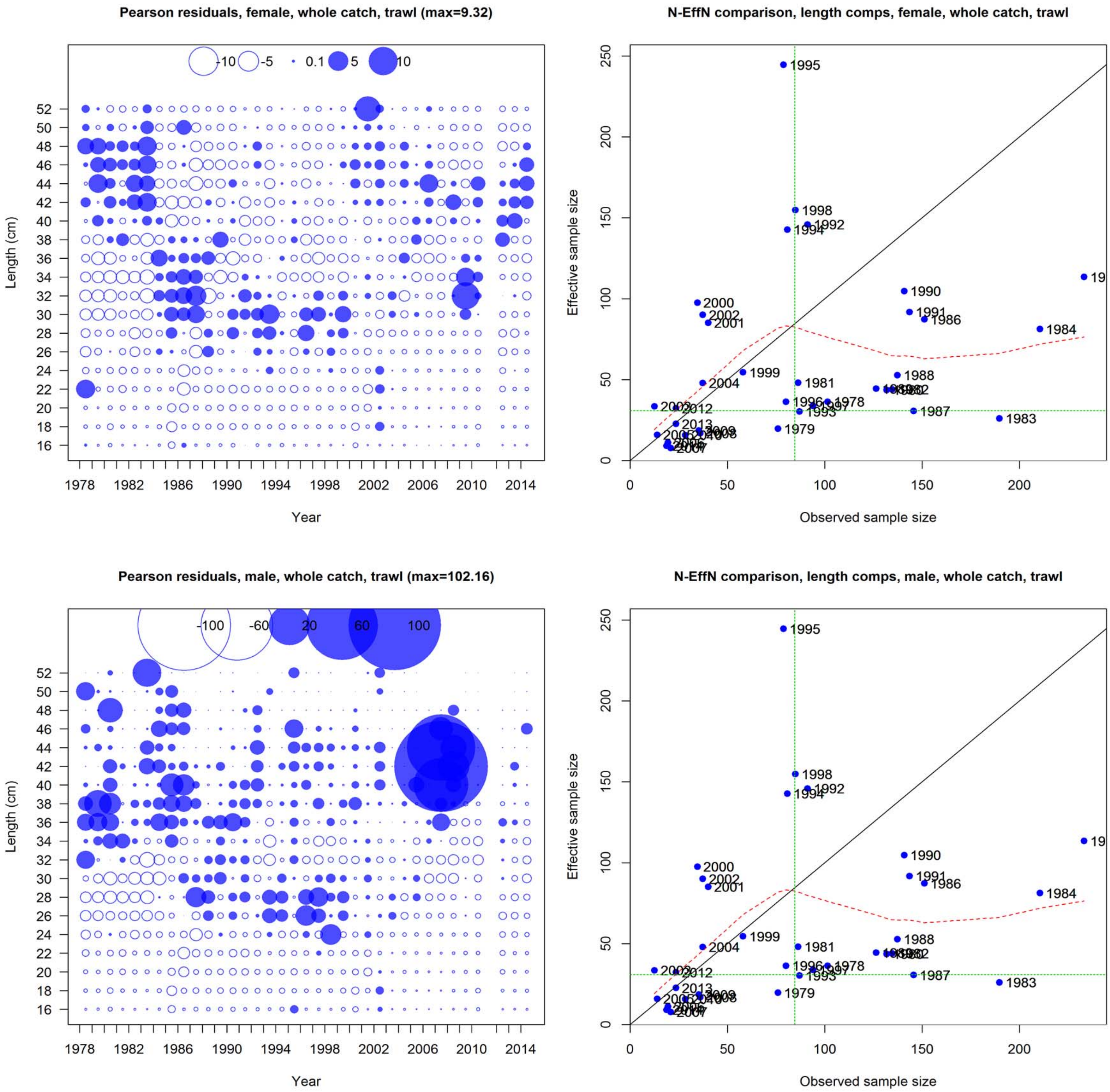

Figure 44a (top) and 1b (bottom Residuals and effective sample size comparisons associated with the fits to female length composition data from the trawl fishery.

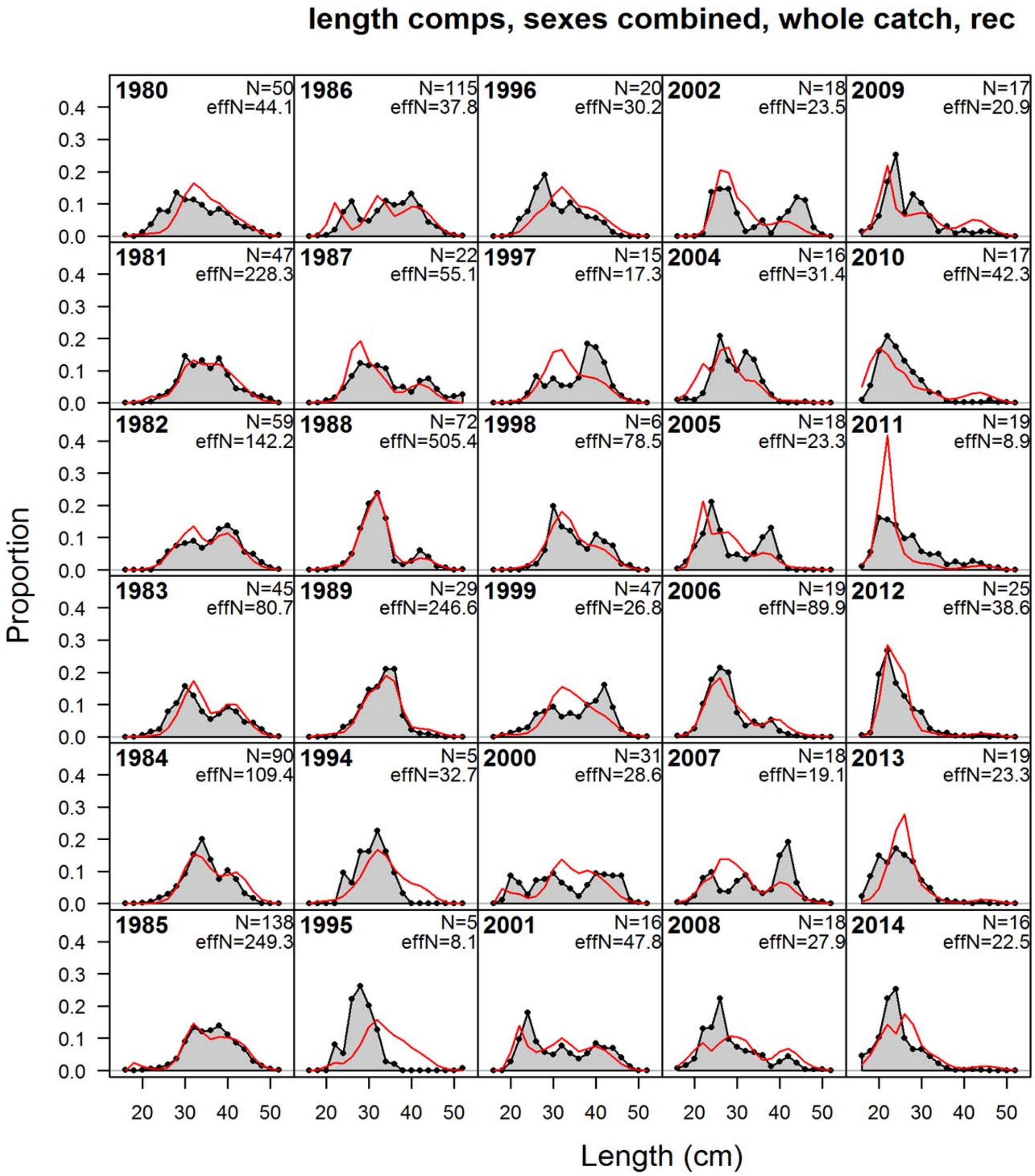

Figure 45a (top) and 1b (bottom): Estimated recruitments and recruitment deviations for base model when new survey data are sequentially added.

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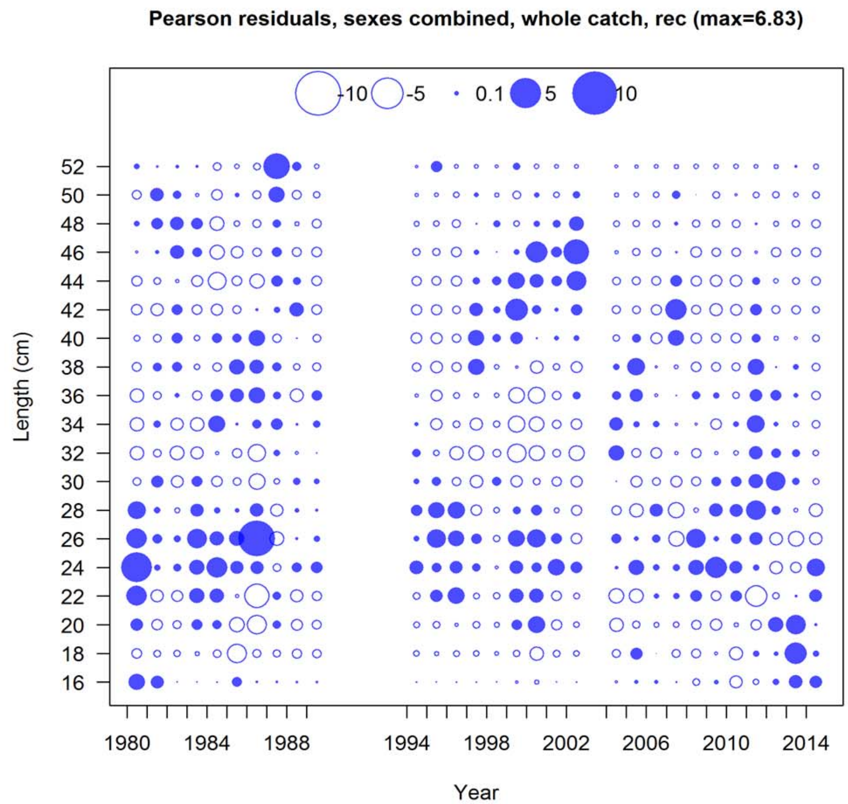

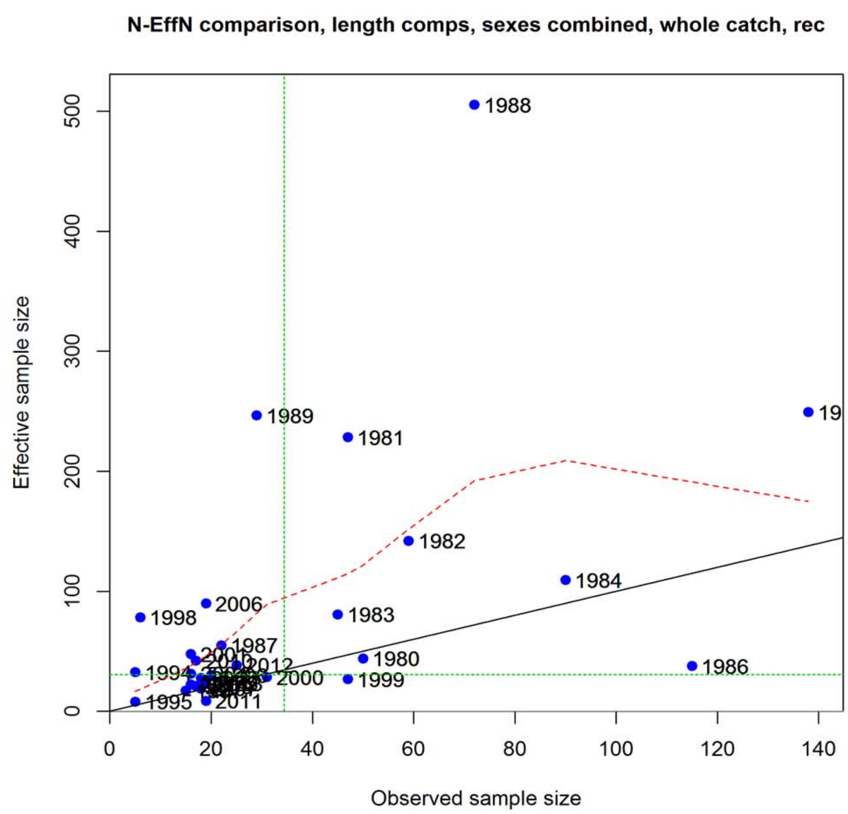

Figure 46a (top) and 1b (bottom): Residuals and effective sample size comparisons associated with the fits to female length composition data from the trawl fishery.

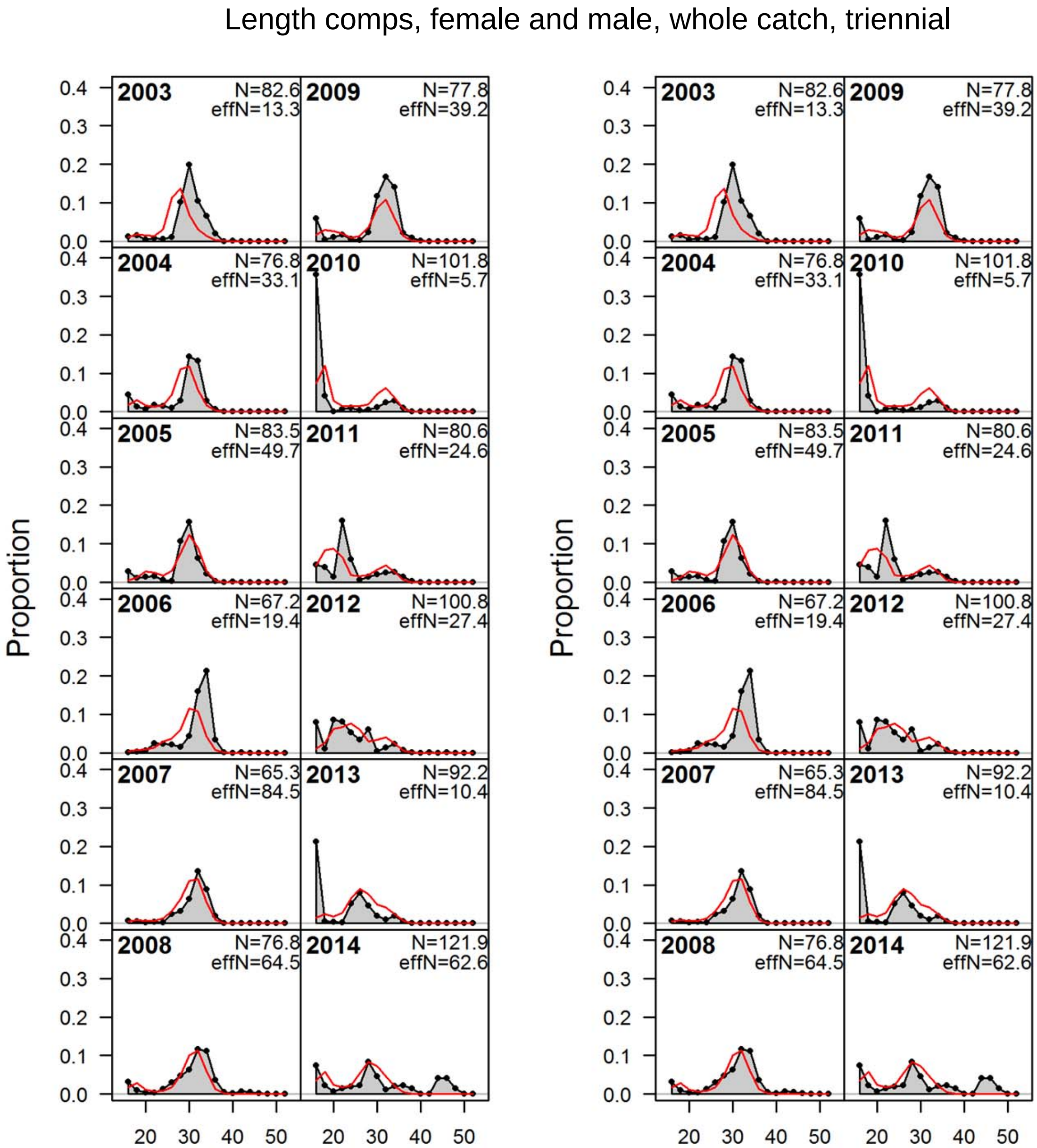

Figure 47a (top) and 1b (bottom): Observed and predicted female and male length composition data from the NWFSC combined bottom trawl survey.

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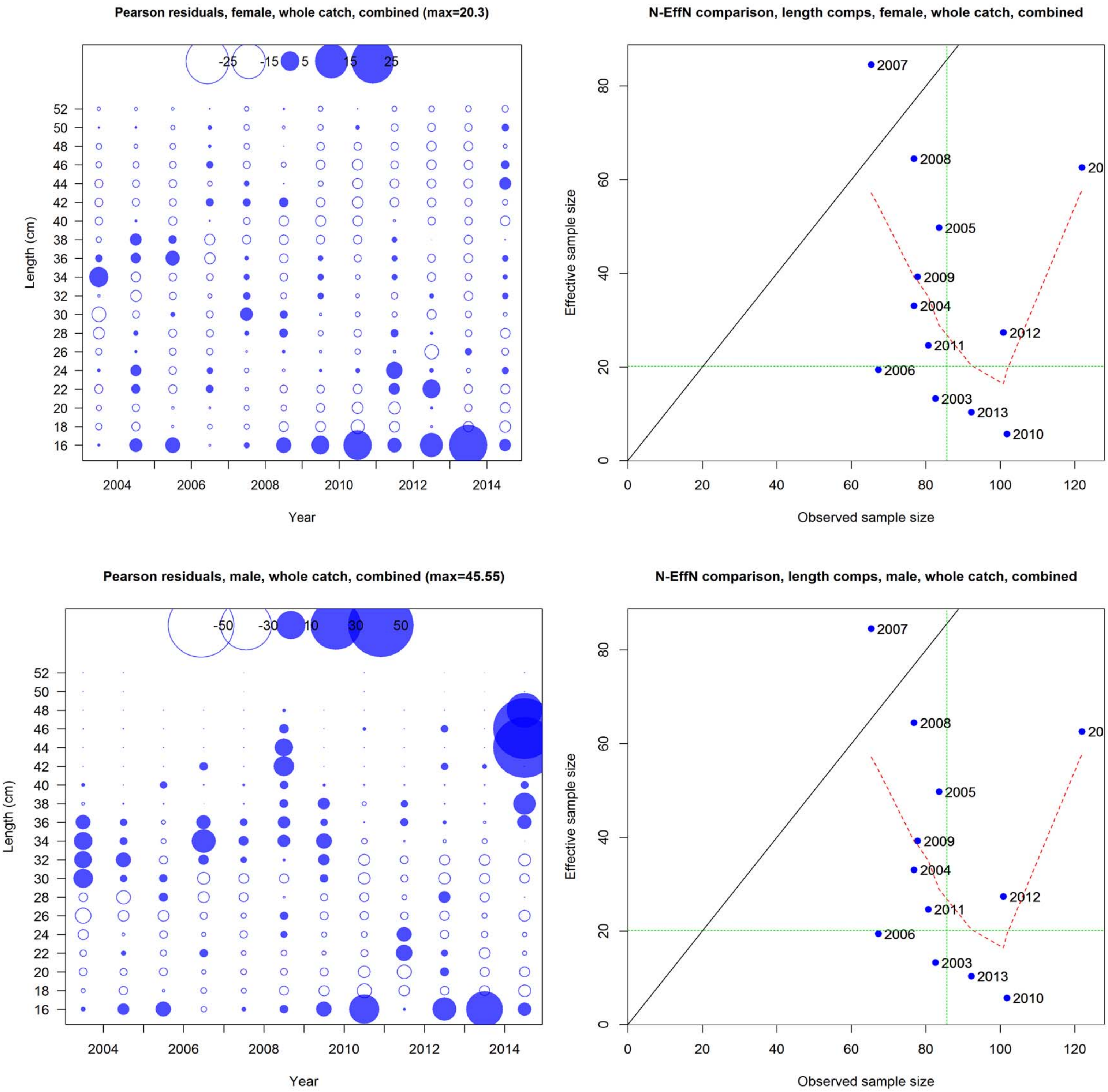
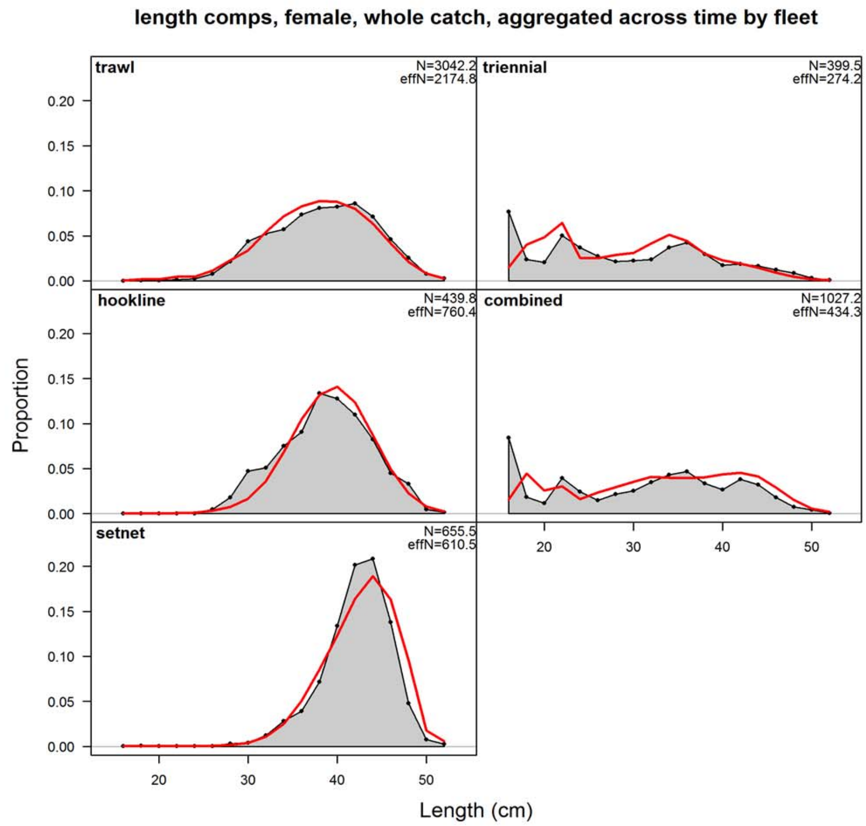


Figure 48a (top) and 1b (bottom): Residuals and effective sample size comparisons associated with the fits to female length composition data from the trawl fishery



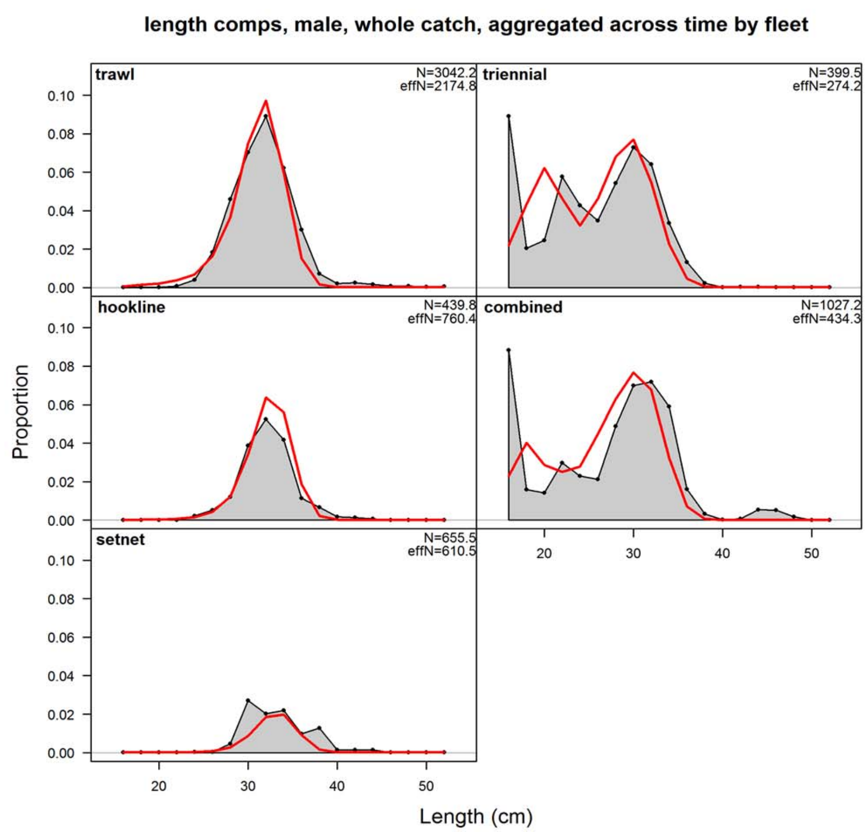
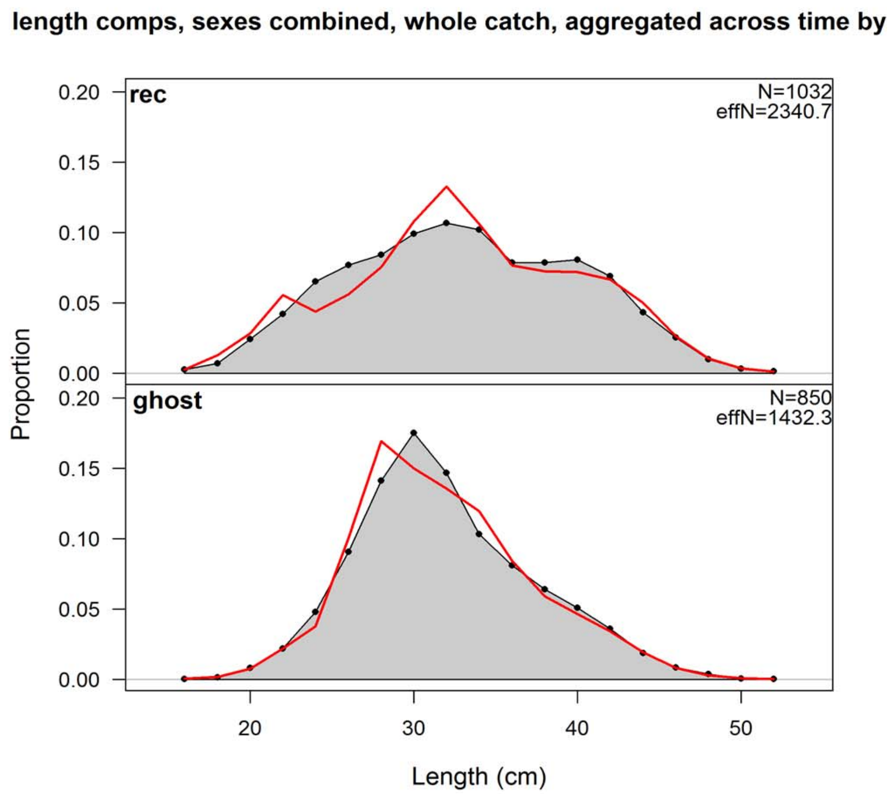


Figure 49a (top) and 1b (bottom): Observed and predicted length composition data for all years combined by fishery and survey.

.



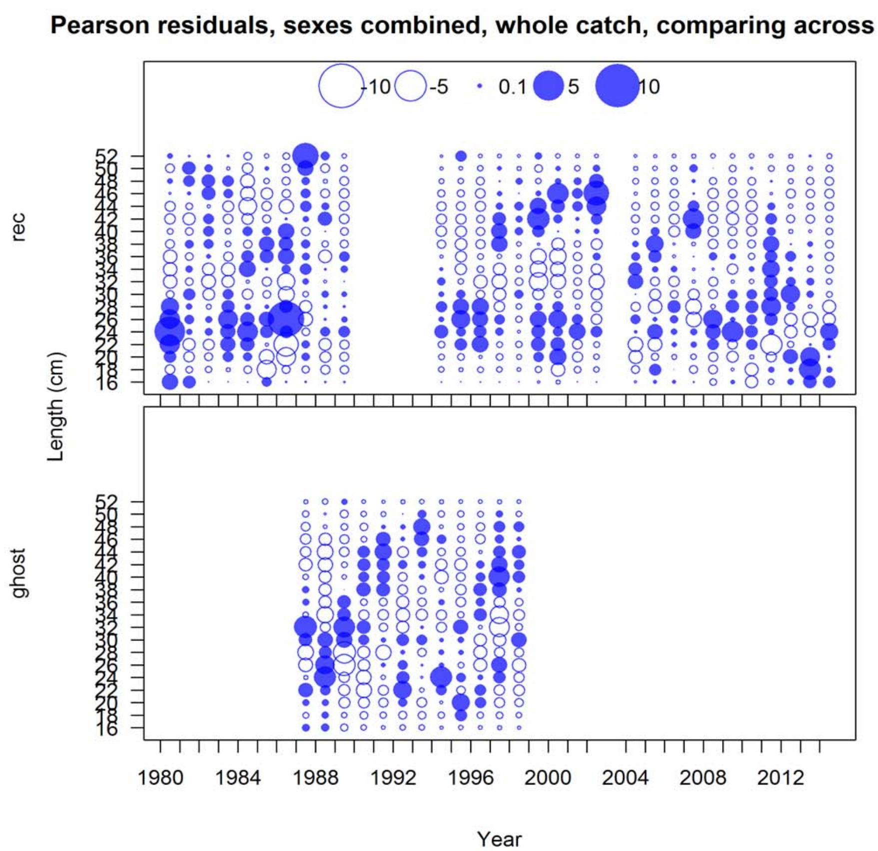


Figure 50a (top) and b (bottom): Observed and predicted fits to length composition data for all years combined for recreational fisheries (sexes combined) with model residuals.

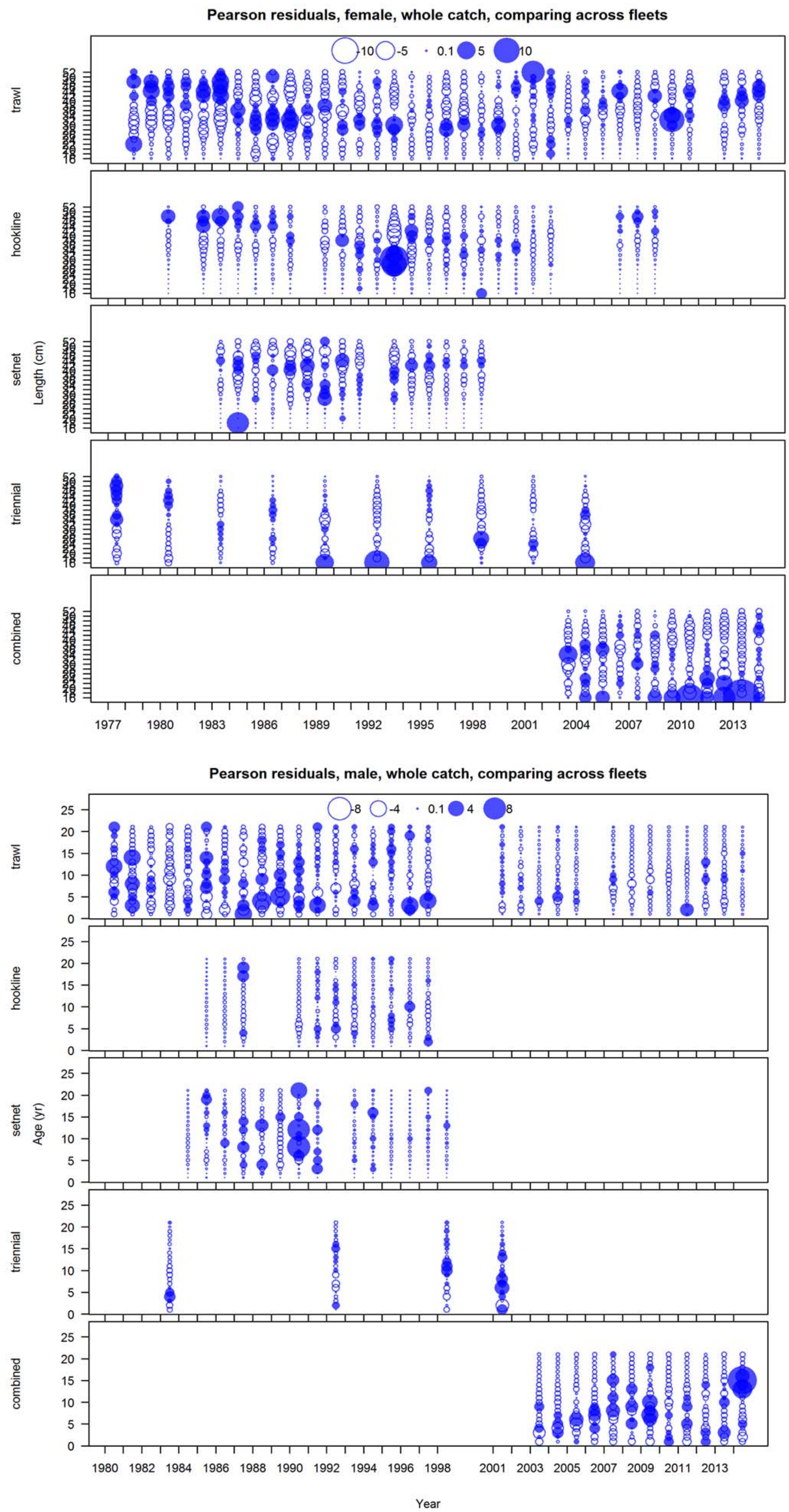


Figure 51a (top) and 1b (bottom): Residuals associated with fits to all years of length composition data (by sex) for commercial fisheries and surveys.

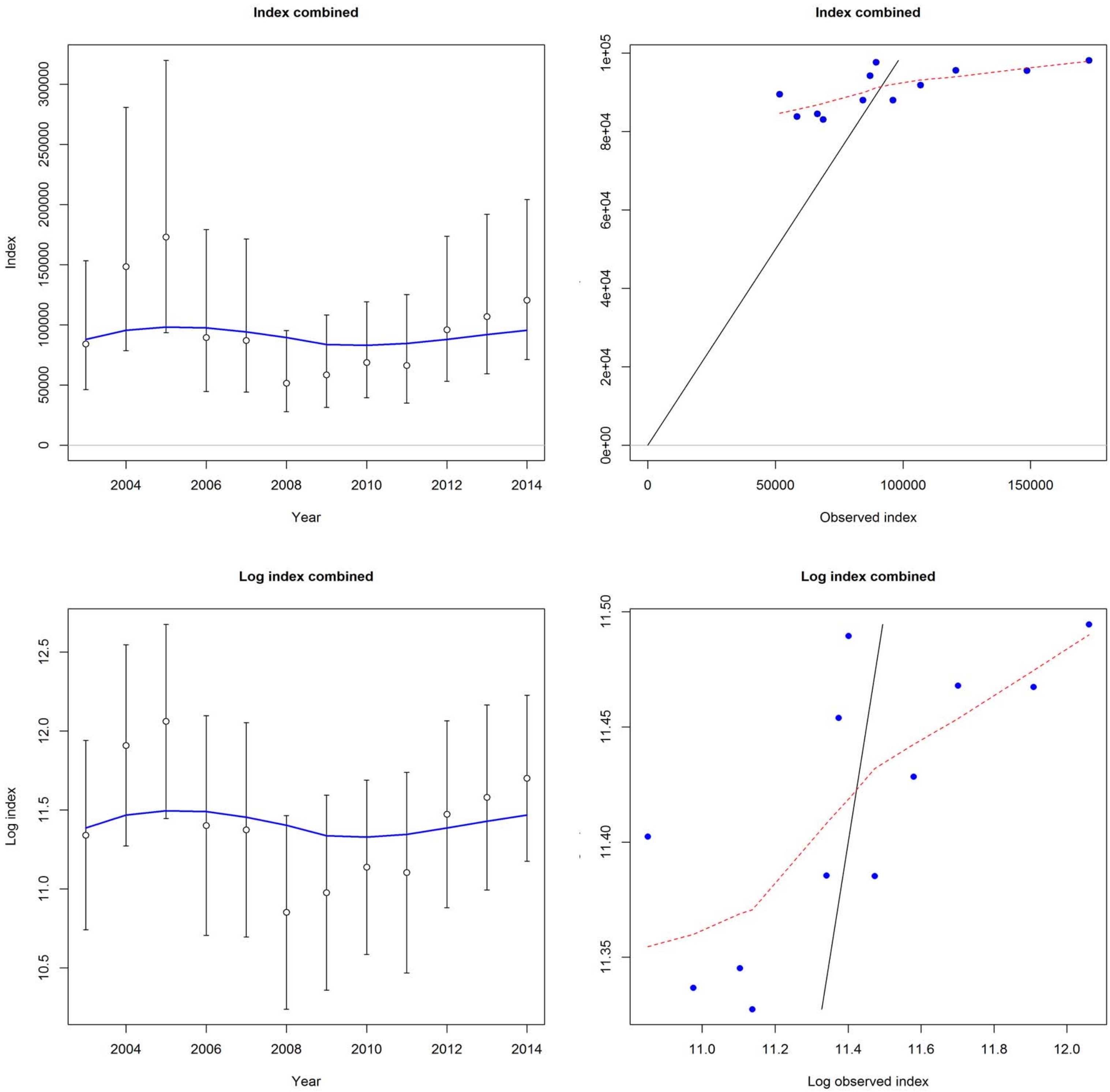


Figure 52a - d: Fits to Combined bottom trawl survey index in arithmetic (top) and log scale (bottom).

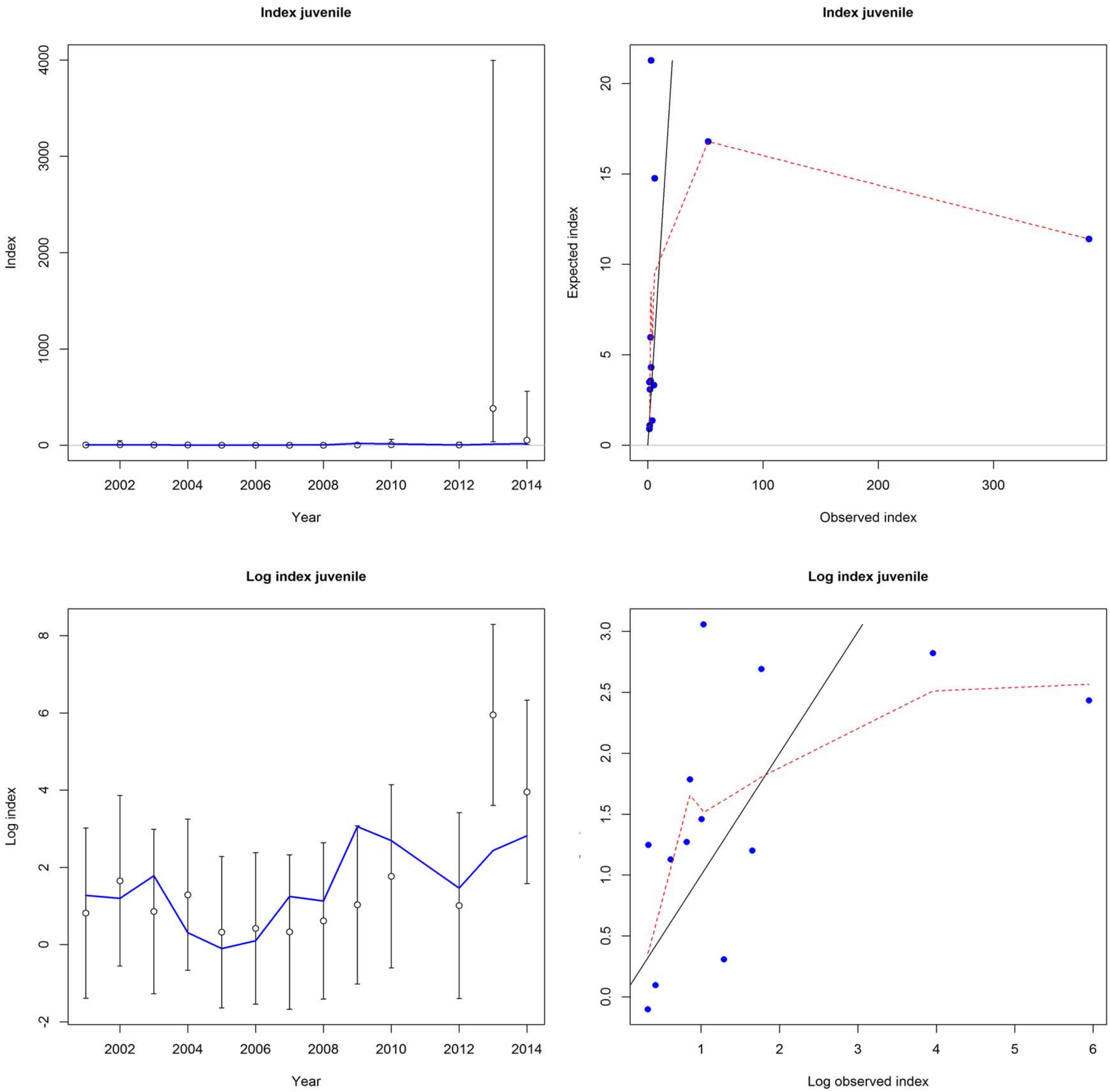


Figure 53a - d: Fits to SWFSC/NWFSC juvenile (age 0) abundance index in arithmetic (top) and log scale (bottom).

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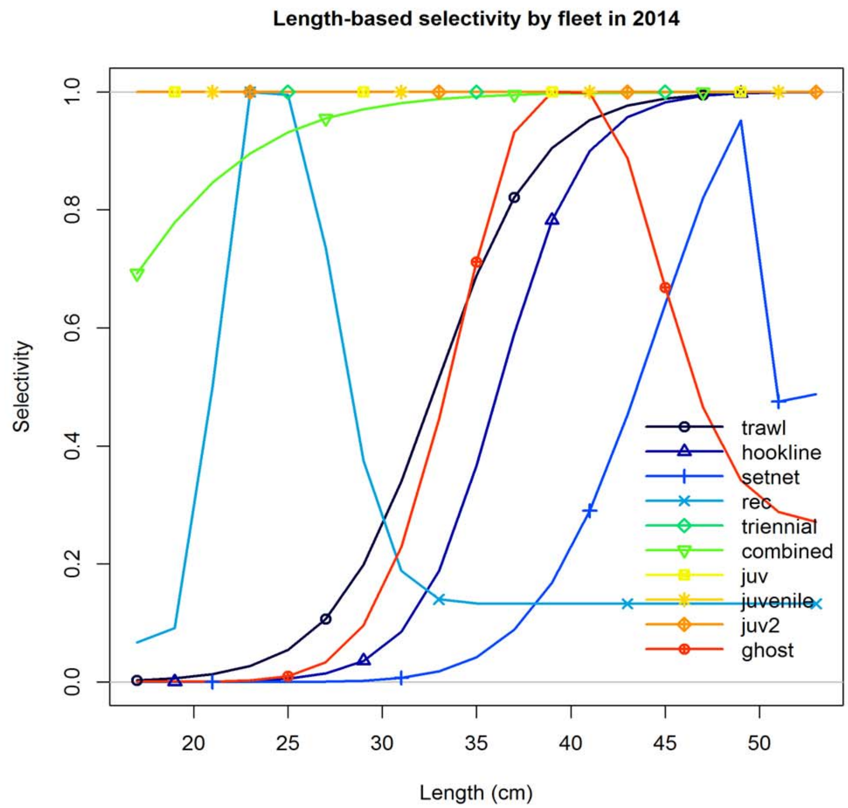

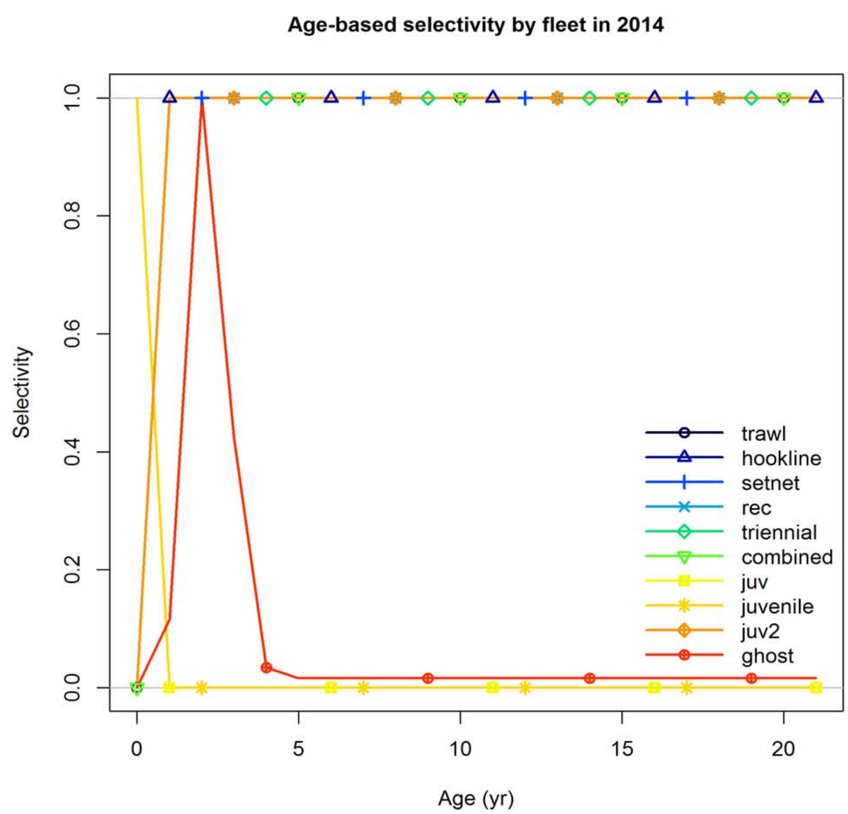

Figure 54a (top) and b (bottom): Estimated length and age selectivity for fisheries and survey s in the base model.

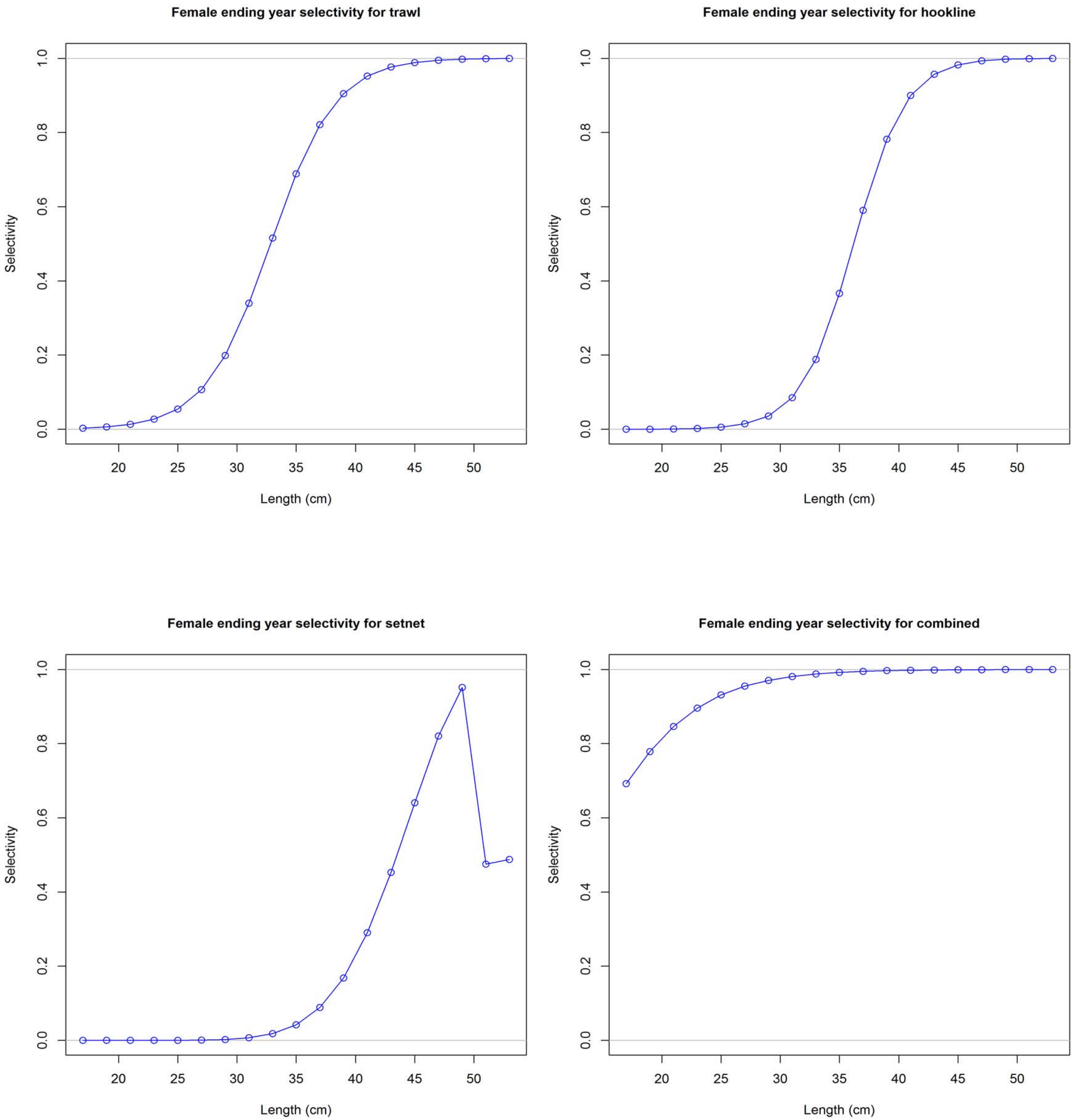

Figure 55a-d: Estimated (or fixed) length and age selectivity for fisheries and survey s in the base model.

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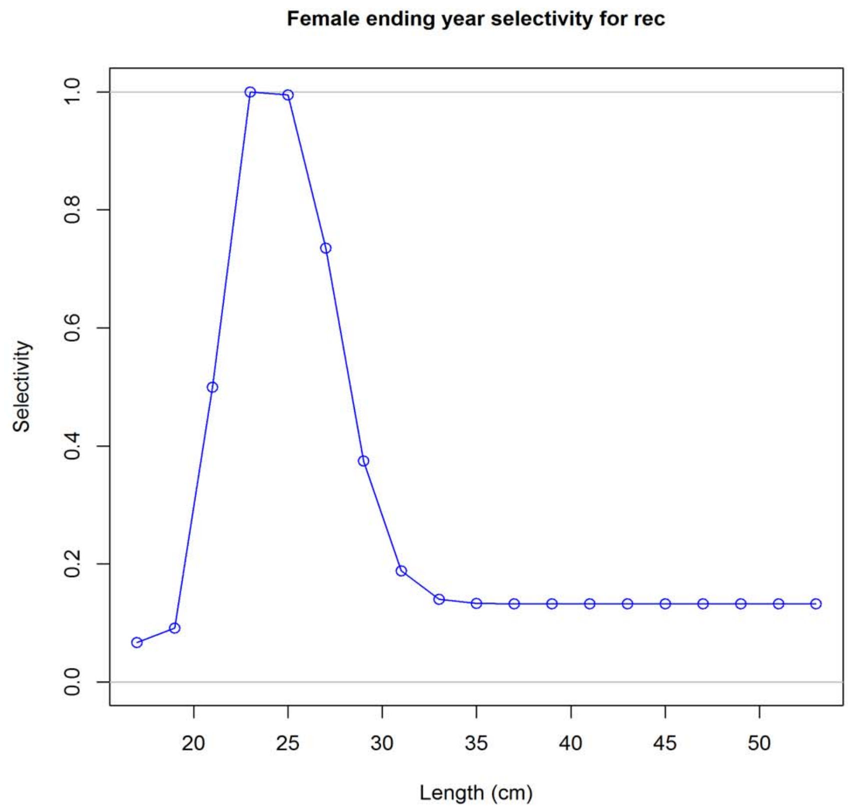


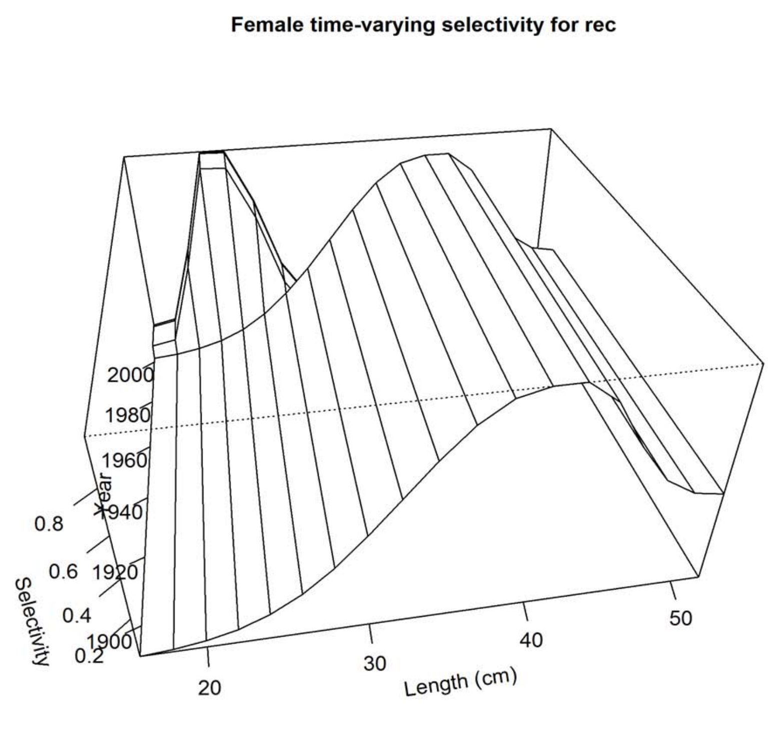


Figure 56a (top) and b (bottom): Estimated selectivity for the recreational fishery, ending time block (top) from 2003-2014, over time (bottom) showing the selectivity curve for the period prior to 2003.

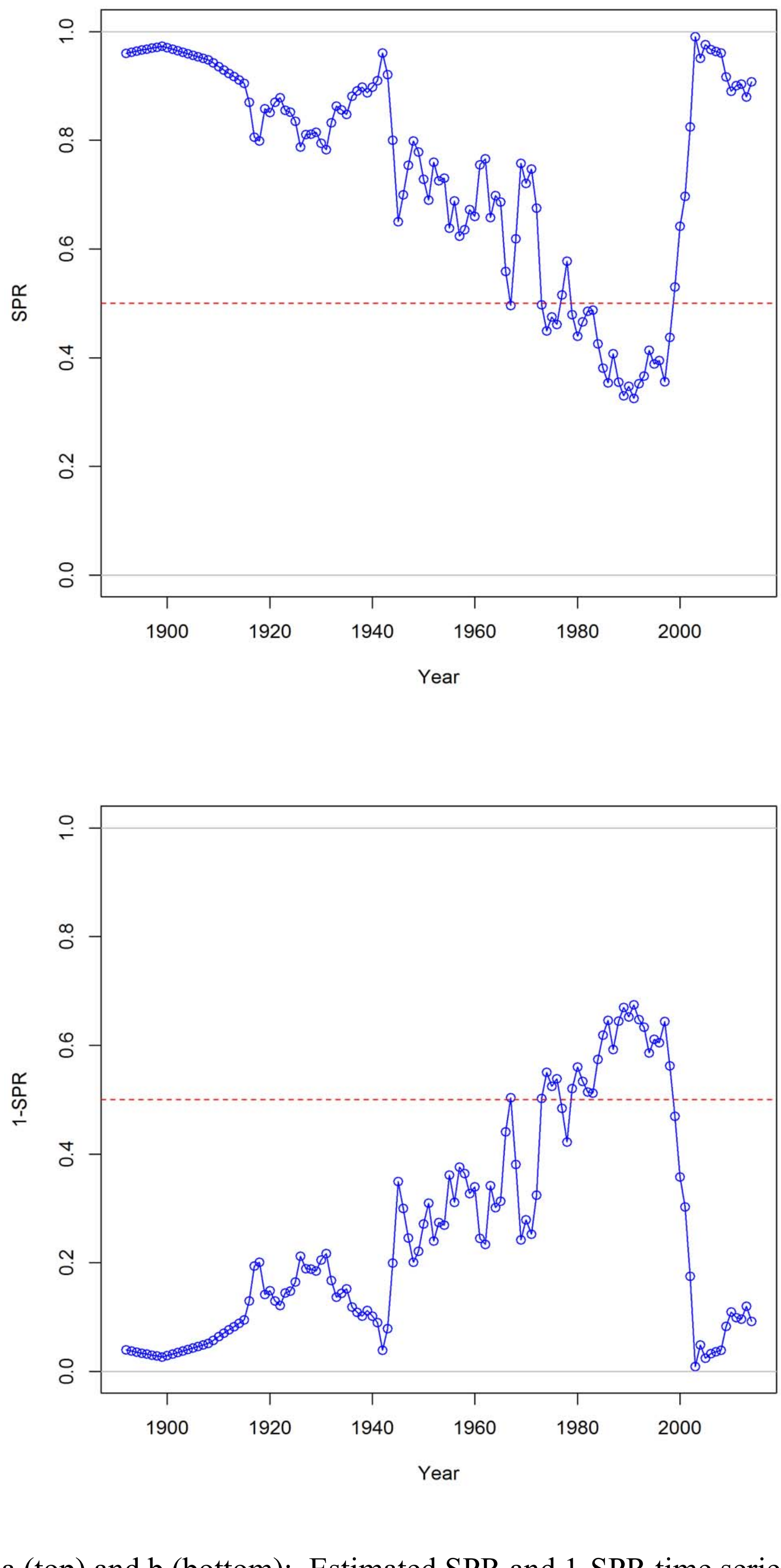
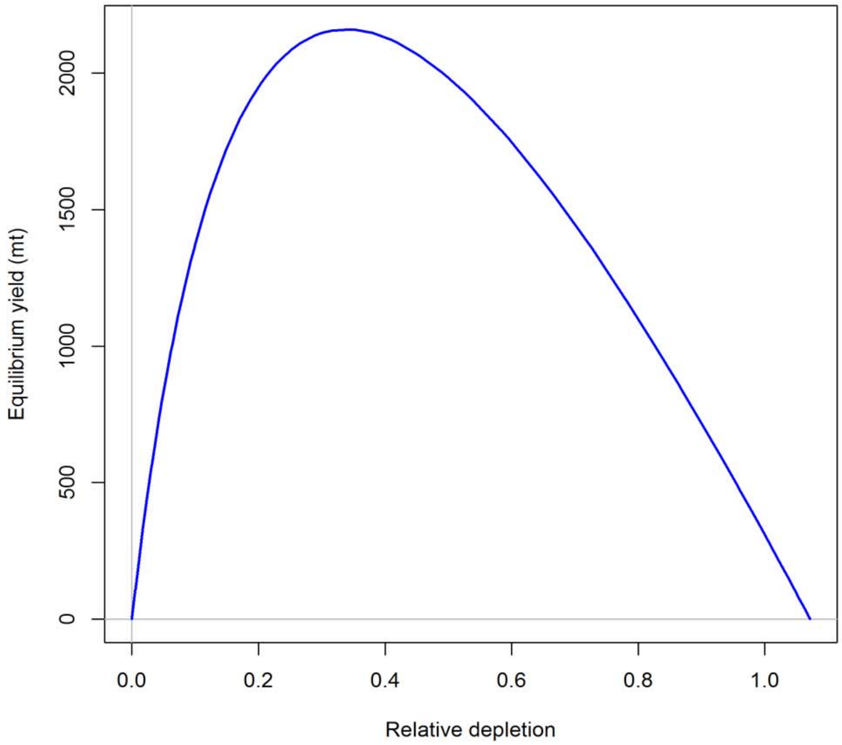


Figure 57a (top) and b (bottom): Estimated SPR and 1-SPR time series for 2015 base model.



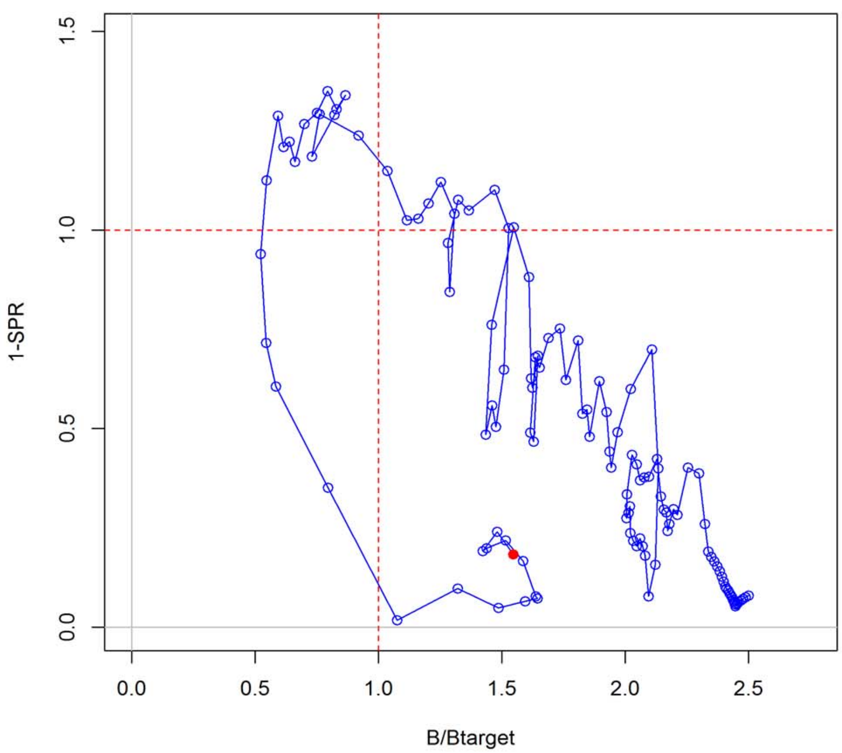
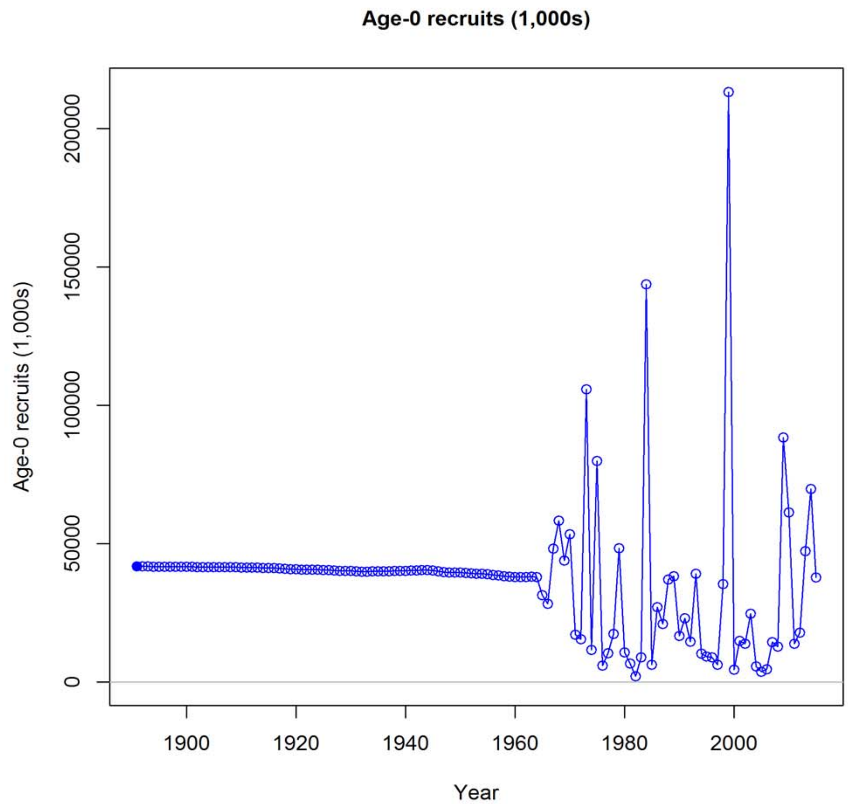


Figure 58a (top) and b (bottom): Estimated yield curve and phase plot for 2015 base model



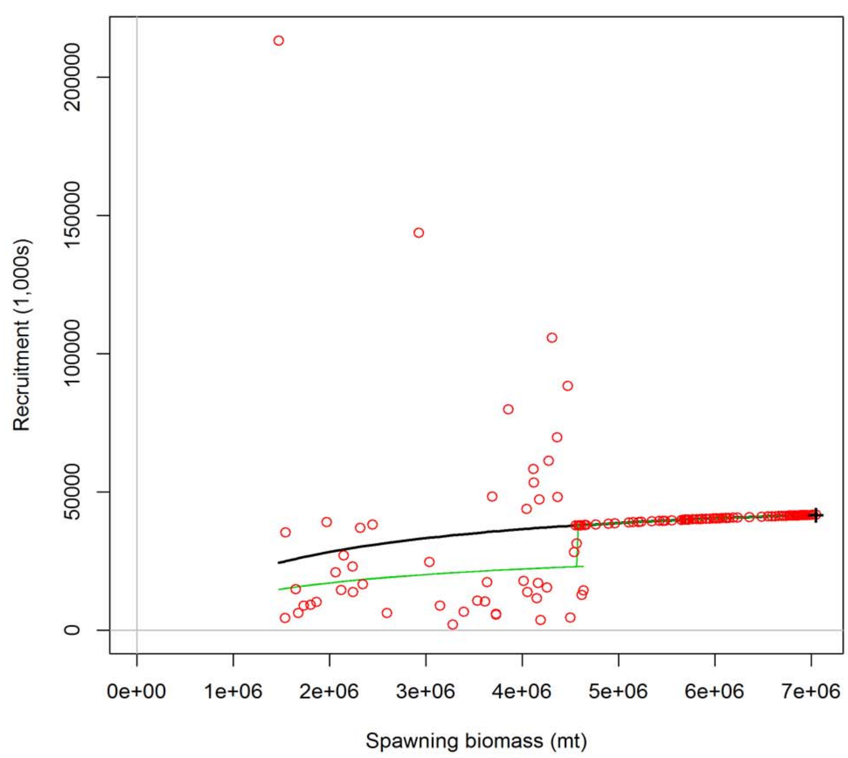
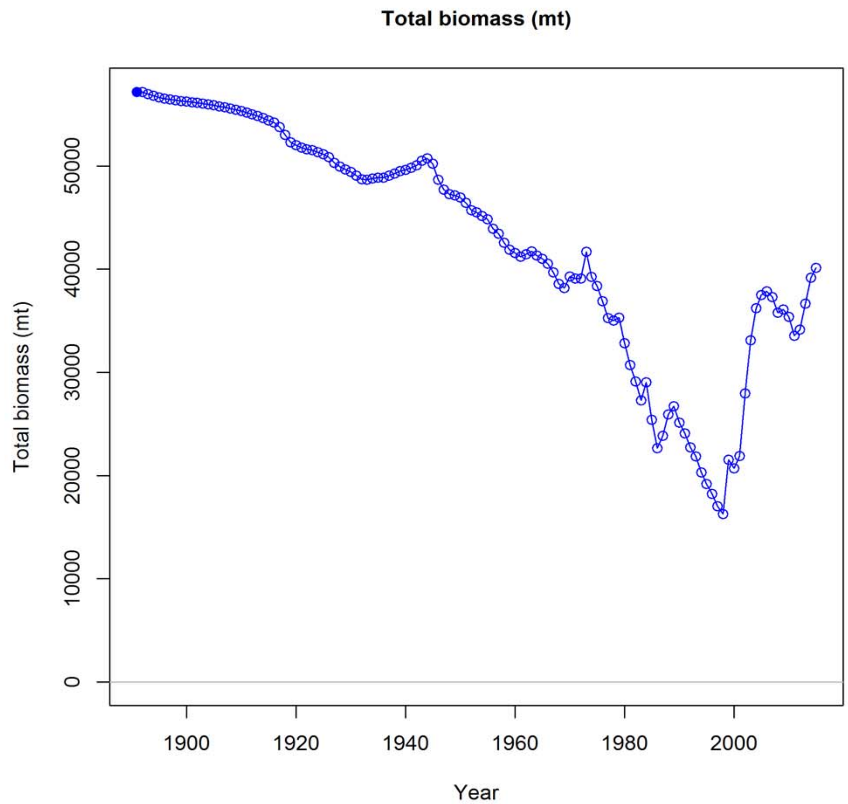


Figure 59a (top) and b (bottom): Estimated recruitments and spawner recruit curve for the 2015 base model.



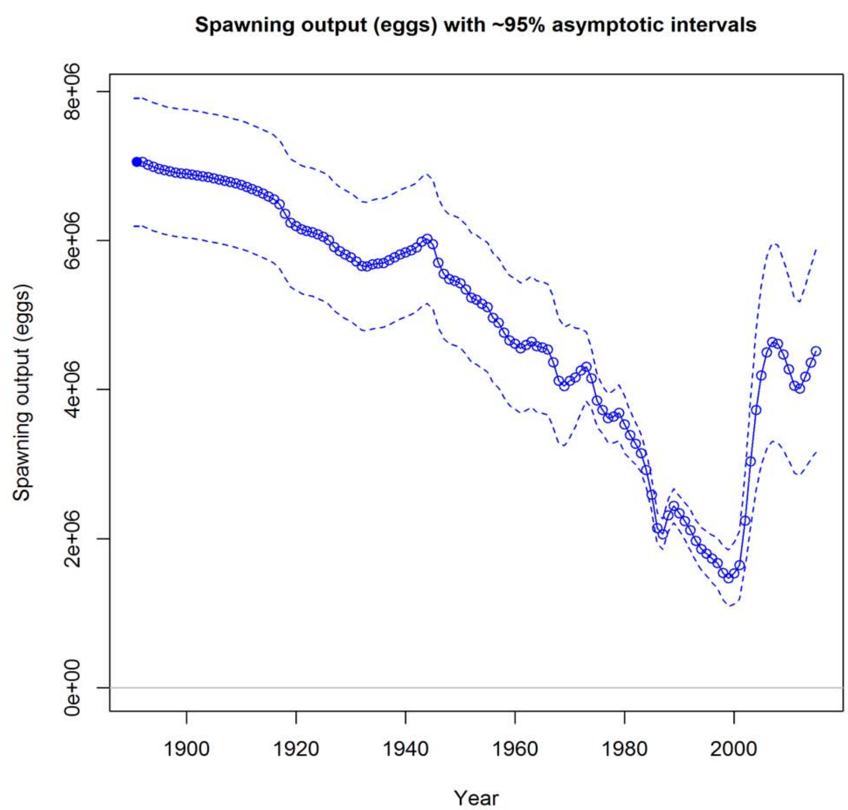


Figure 60a (top) and b (bottom): Estimated total biomas and spawning output time series for the 2015 base model.

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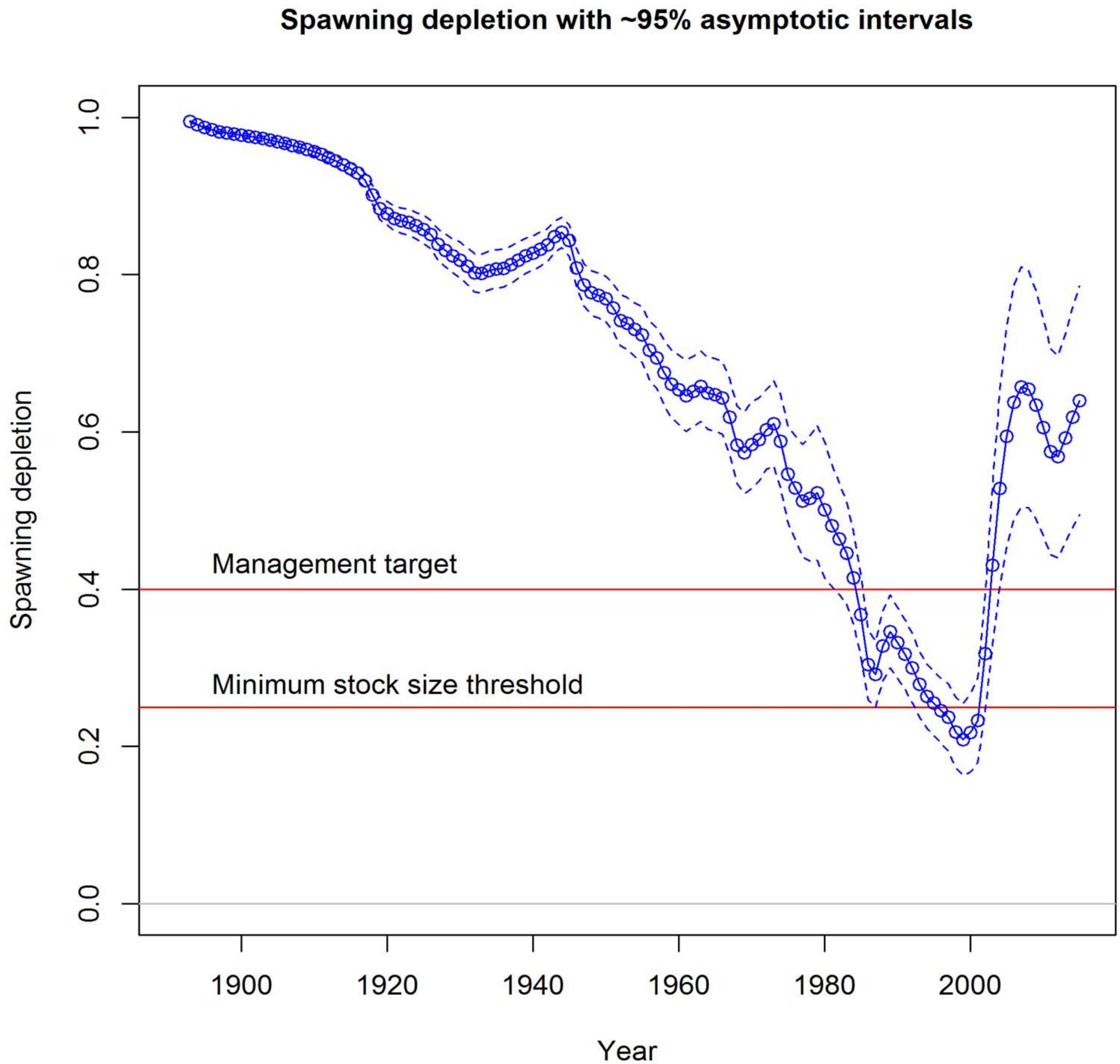

Figure 61: Estimated depletion for the 2015 base model

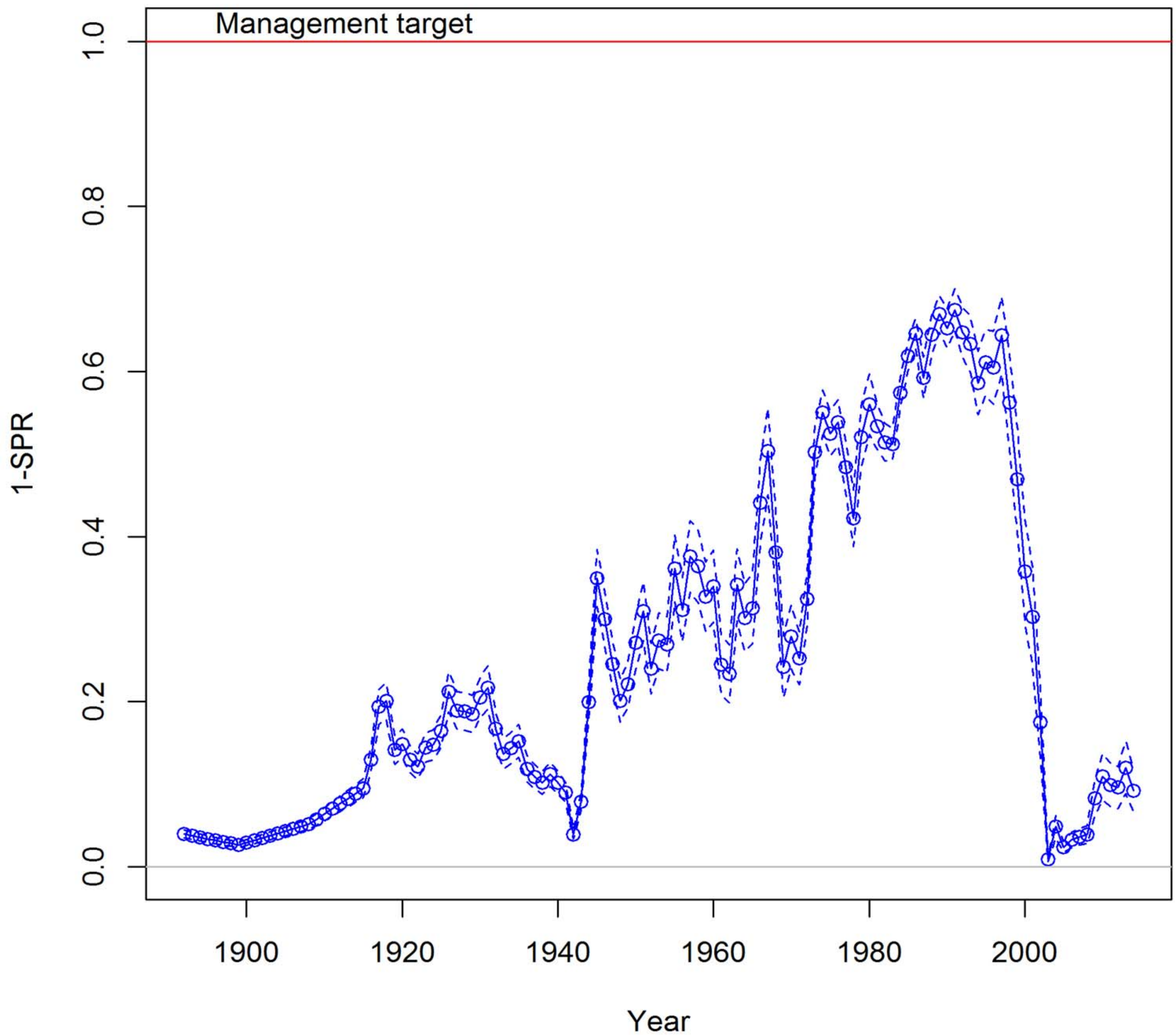

Figure 62: Estimates of 1-SPR for the 2015 base model

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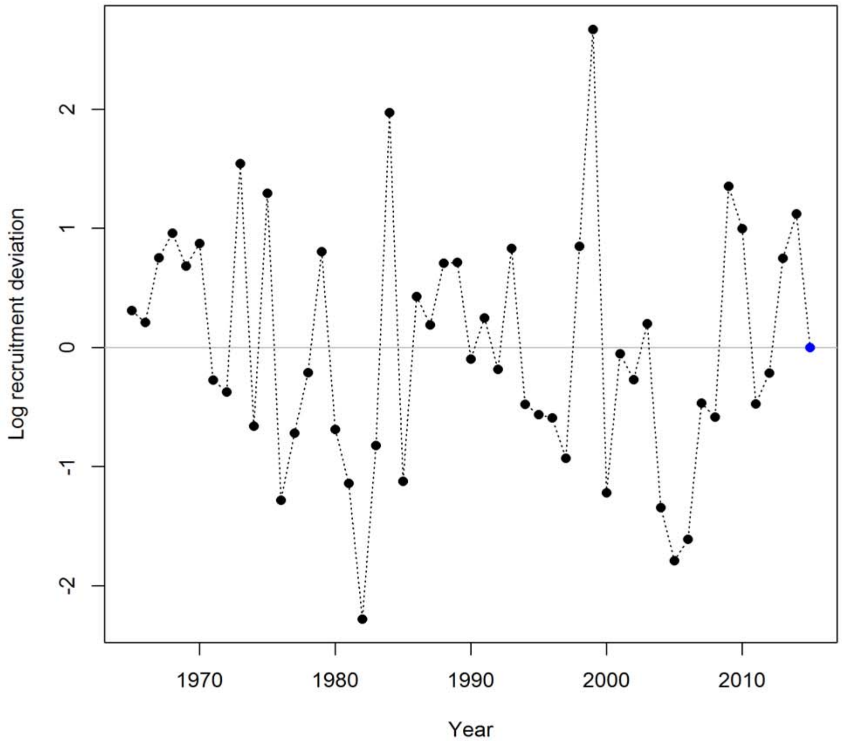

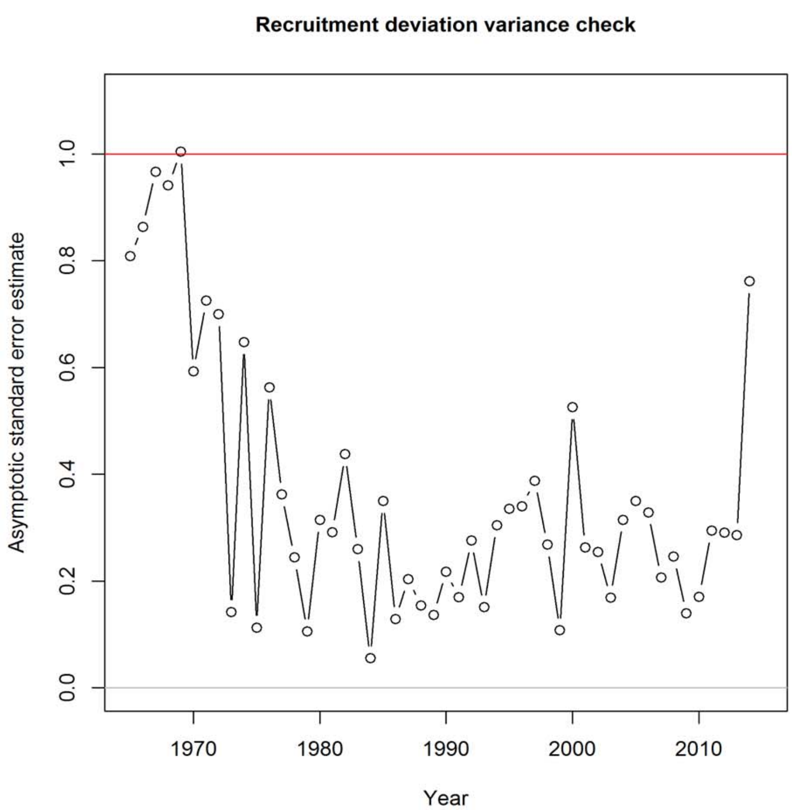

Figure 63a (top) and b (bottom): Estimated recruitment deviation and recruitment deviation variance estimates for the base model.

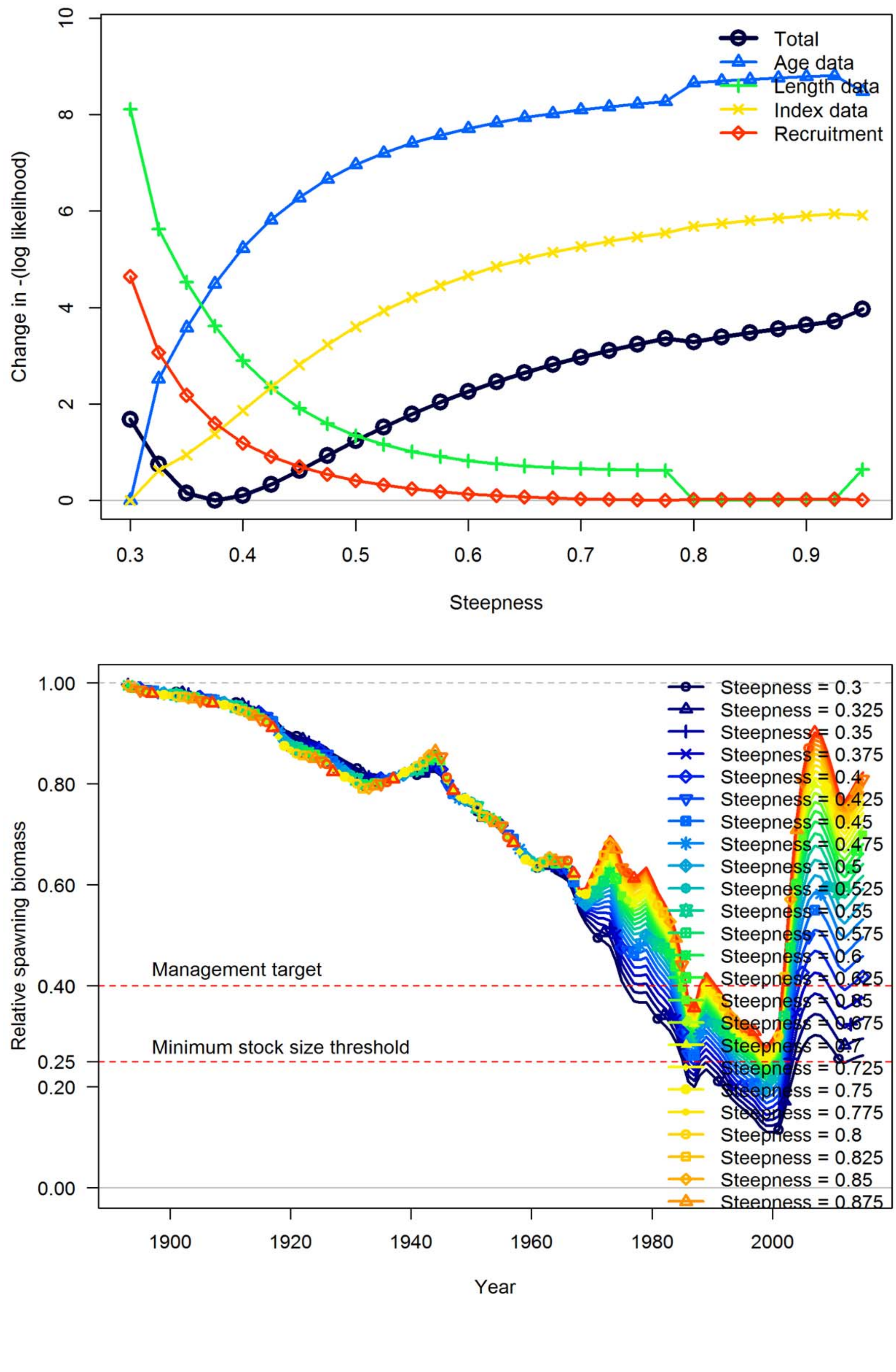

Figure 64a (top) and b : Likelihood profile across steepness and resulting depletion estimates.

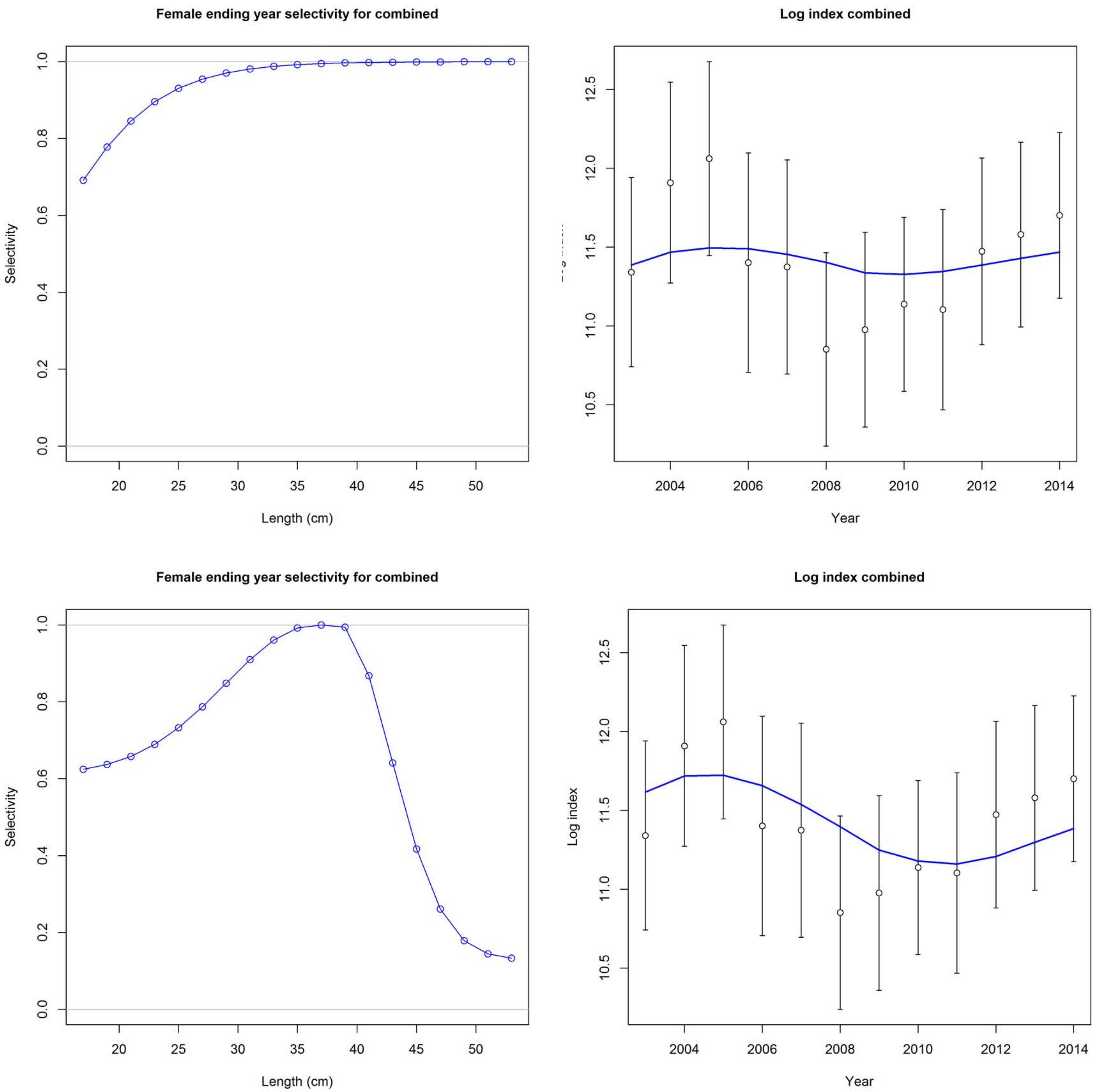

Figure 67a-d: Estimated selectivity curves for the NWFSC bottom trawl survey, and associated fits to the bottom trawl index, using dome shaped versus asymptotic selectivity.

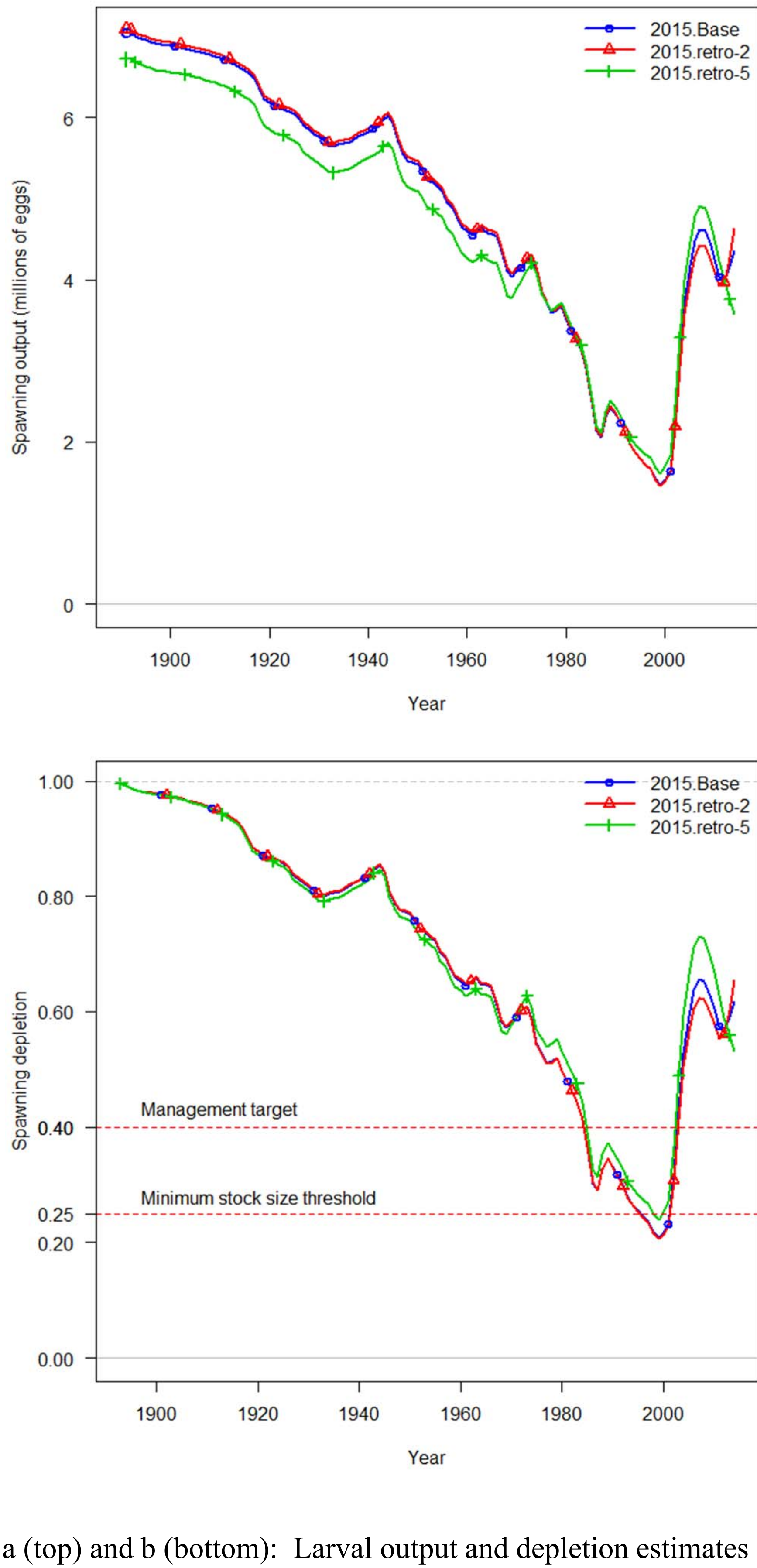

Figure 65a (top) and b (bottom): Larval output and depletion estimates with retrospective analyses

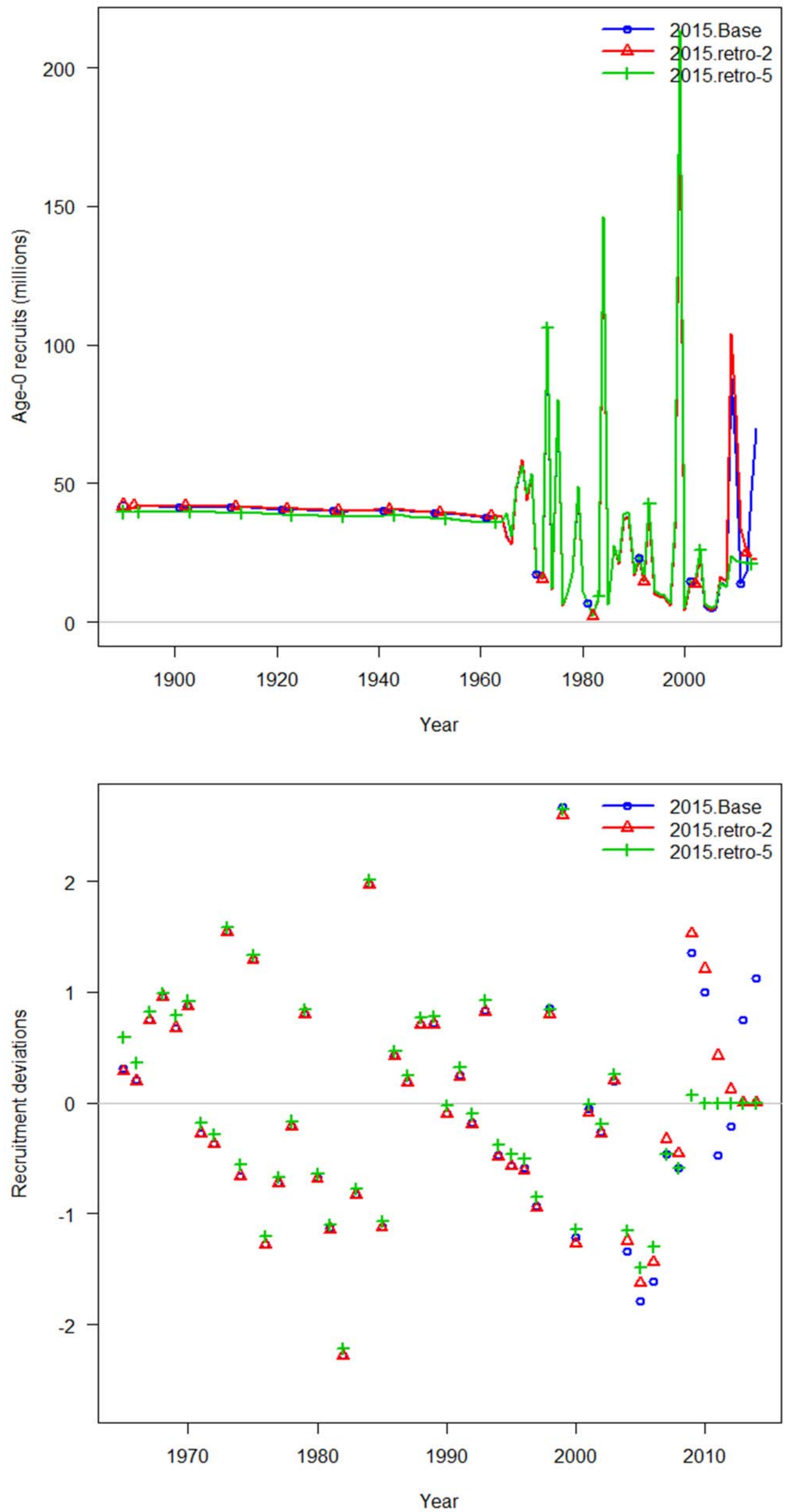

Figure 66a (top) and b (bottom): Recruitment and recruit deviation estimates with retrospective analyses

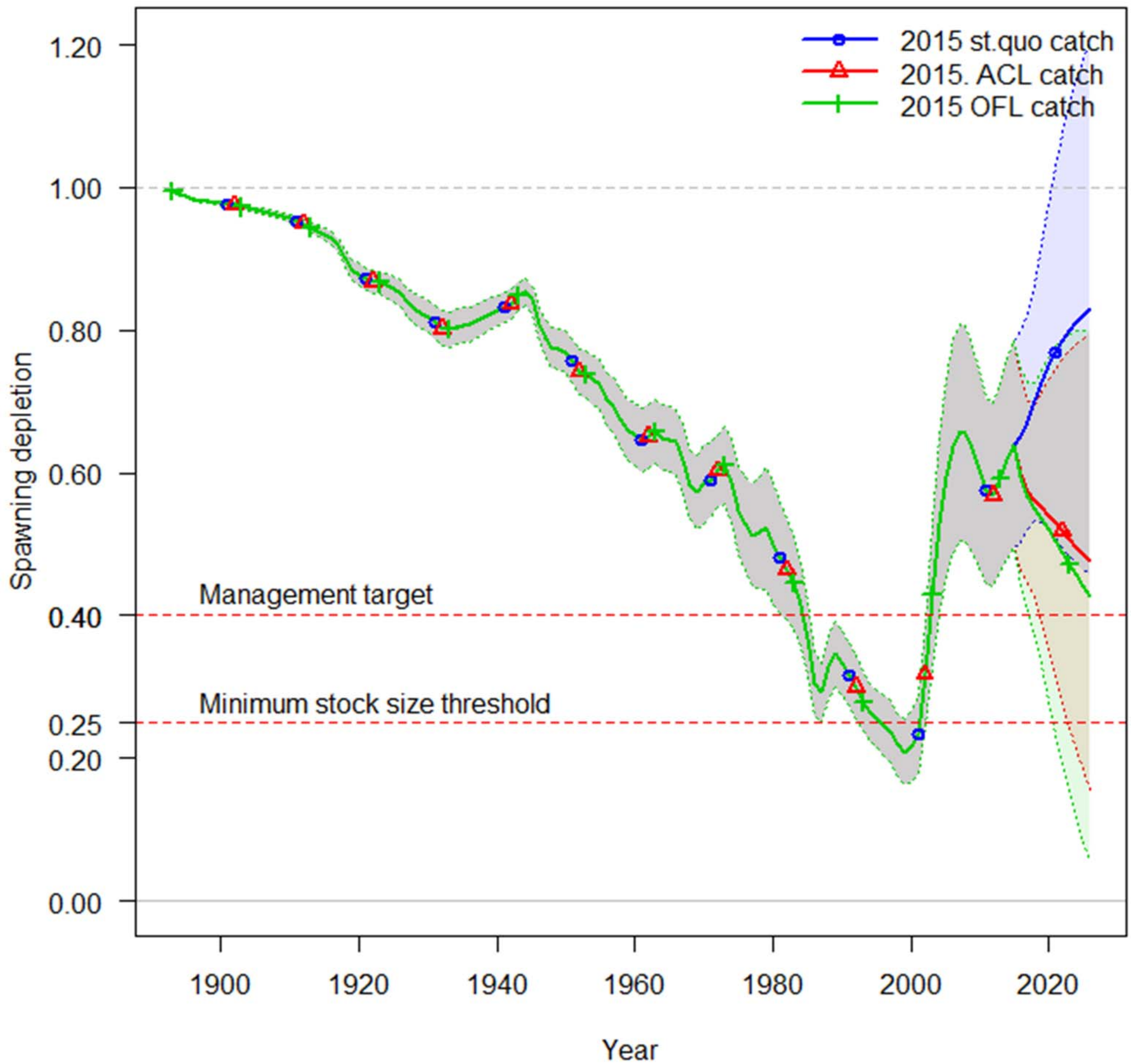

Figure 68: Estimated and forecast relative depletion in base model with alternative catch streams

.

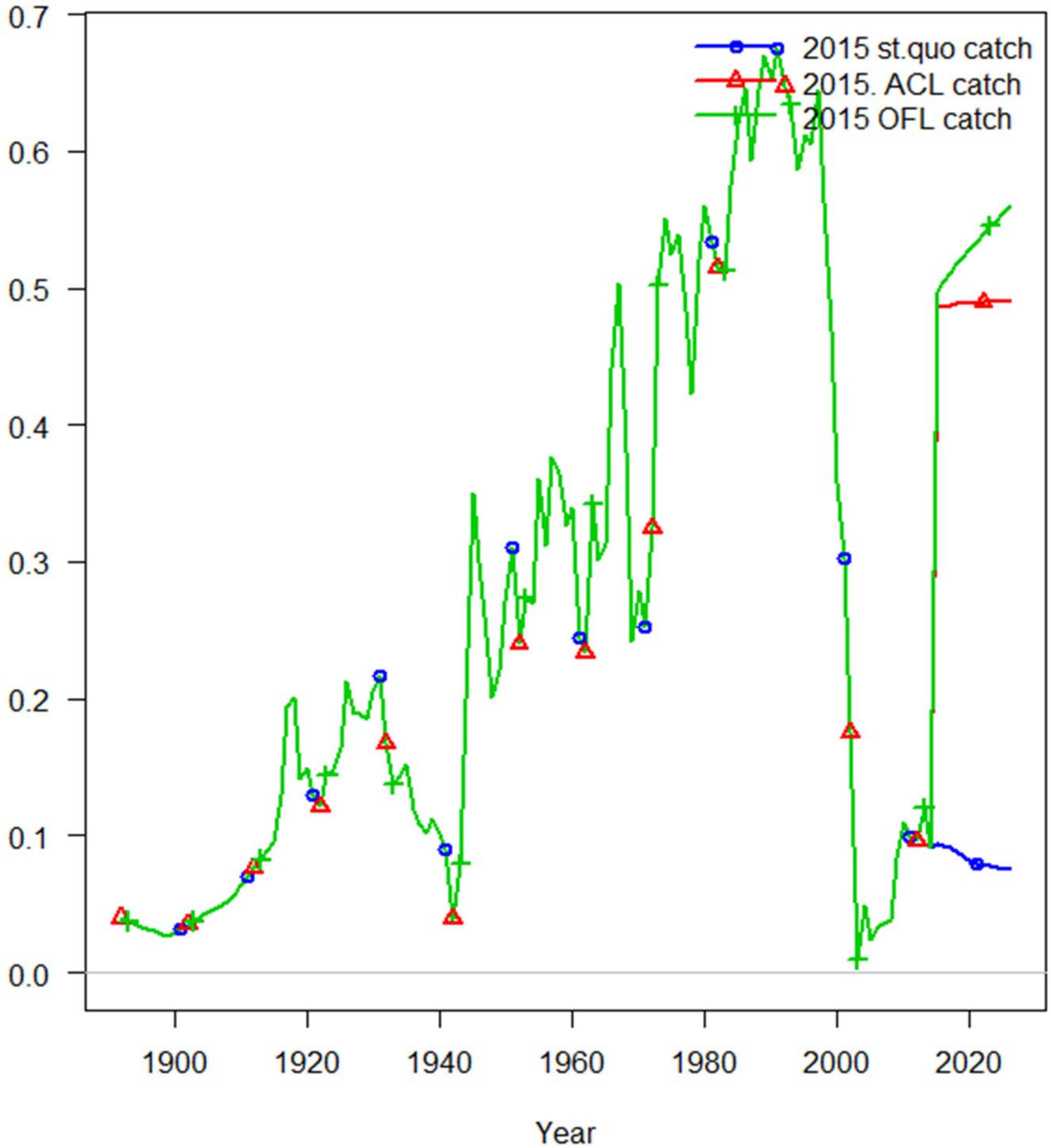

Figure 69: Estimated and forecast (to 2026) 1-SPR for base model with alternative catch streams

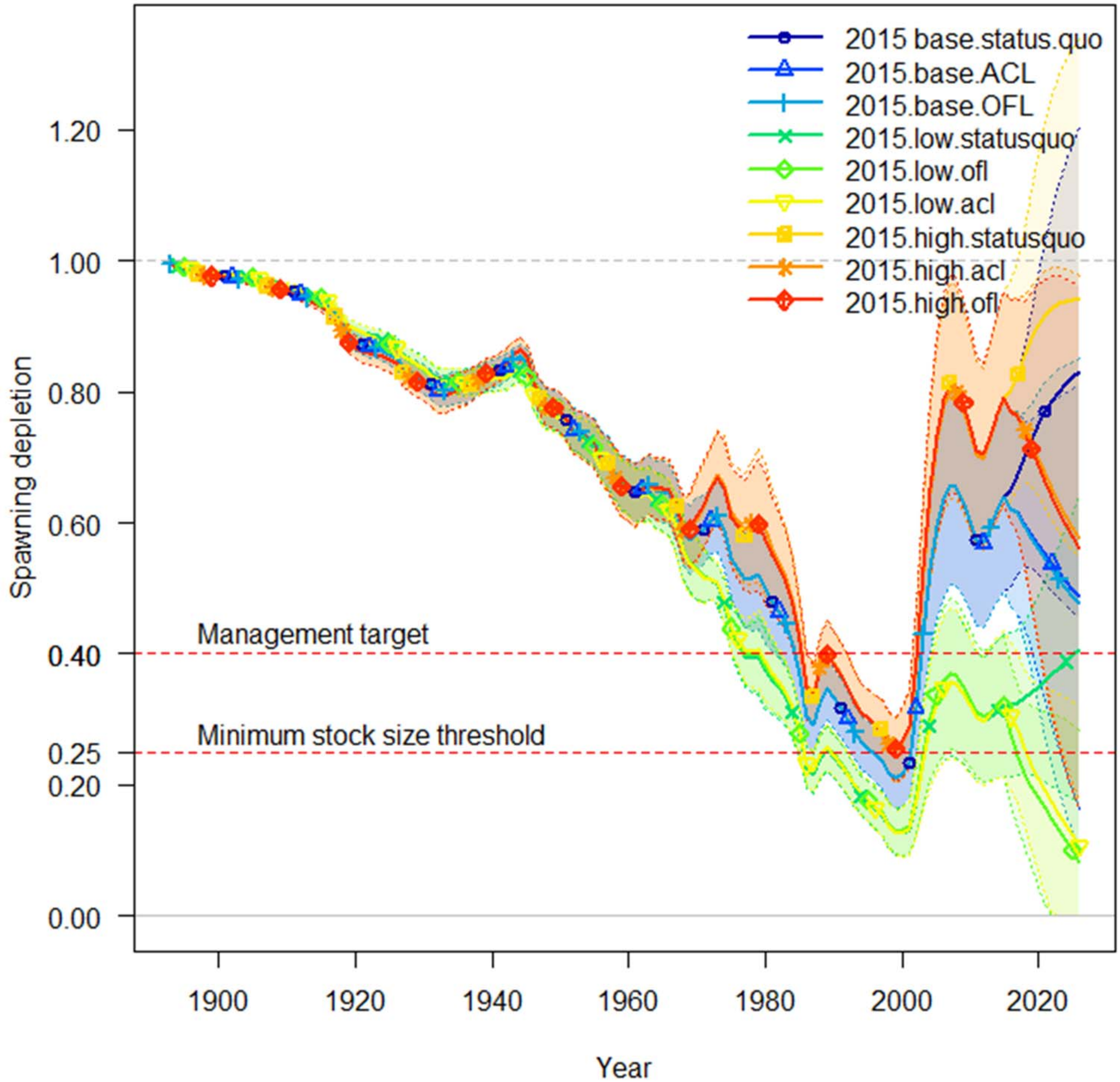

Figure 70: Estimated and forecast relative depletion with alternative states of nature (productivity) and catch streams

.

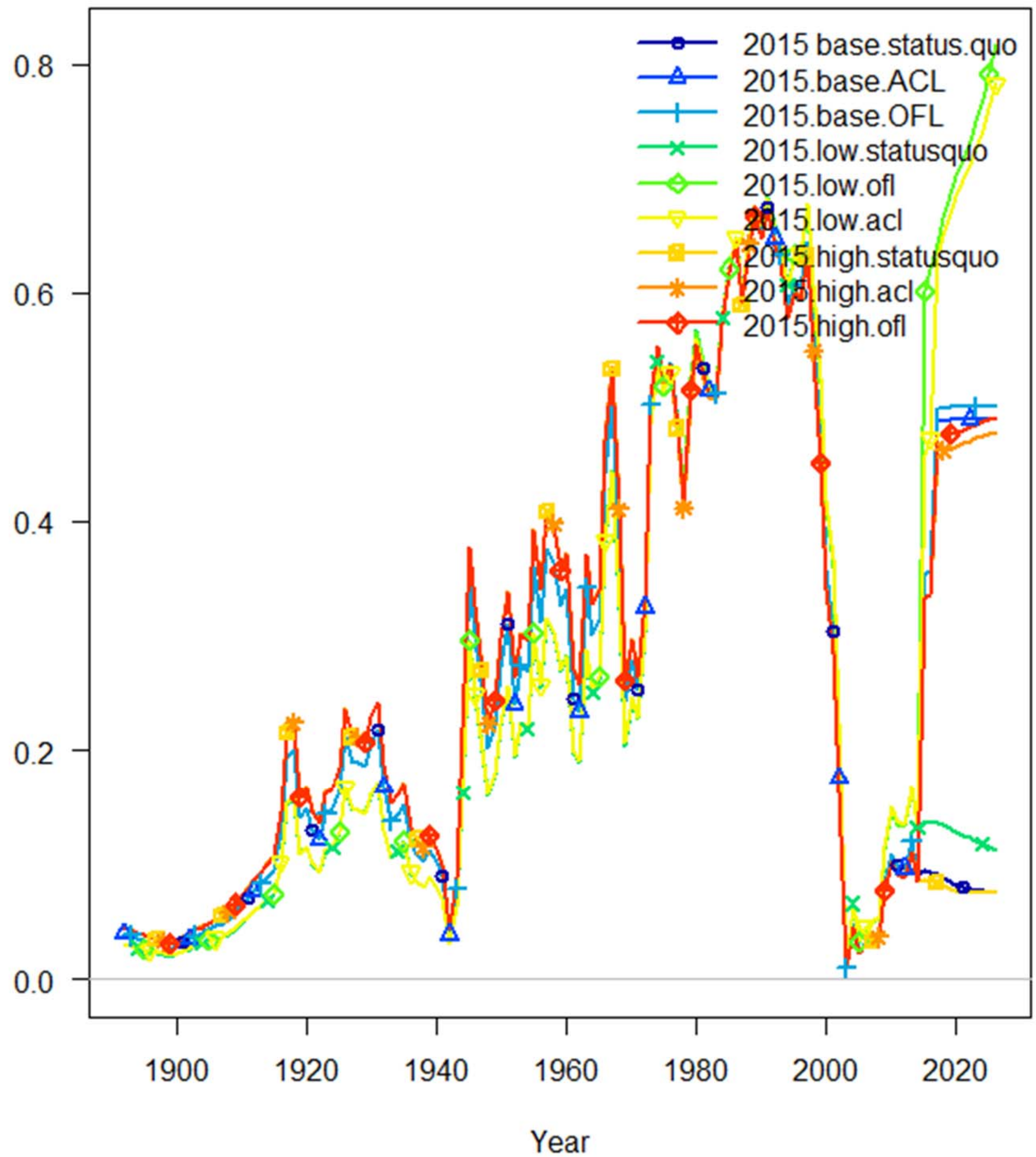

Figure 71: Estimated and forecast (to 2026) 1-SPR for base model and alternative states of nature models with alternative catch streams

Q: SS3 MODEL CODE FOR 2015 CHILIPEPPER ASSESSMENT UPDATE

Starter file

```
##  SS3 Version 3.20
##
##  Data & Control Files
chili.2015.v16.dat
chili.2015.v16.ctl
##
0       # 0=use init values in control file; 1=use ss2.par
0       # run display detail (0,1,2)
2       # detailed age-structured reports in SS2.rep (0,1)
1       # write detailed checkup.sso file (0,1)
1       # write parm values to ParmTrace.sso (0=no,1=good,active; 2=good,all; 3=every_iter,all_parms)
0       # write to cumreport.sso (0=no,1=like&timeseries; 2=add survey fits)
0       # Include prior_like for non-estimated parameters (0,1)
1       # Use Soft Boundaries to aid convergence (0,1) (recommended)
1       # Number of bootstrap datafiles to produce
9       # Turn off estimation for parameters entering after this phase
0       # MCMC burn interval
1       # MCMC thin interval
0.01    # jitter initial parm value by this fraction
-1      # begin annual SD report in start year
-2      # end annual SD report in end year (-2=end of annual SD report in last forecast year
0       # N individual STD years (0=none)

#vector of year values

0.001   # final convergence criteria (e.g. 1.0e-04)
0       # retrospective year relative to end year (e.g. -4)
2       # min age for calc of summary biomass
1       # Depletion basis:  denom is: 0=skip; 1=rel X*B0; 2=rel X*Bmsy; 3=rel X*B_styr
1       # Fraction (X) for Depletion denominator (e.g. 0.4)
4       # (1-SPR)_reporting:  0=skip; 1=rel(1-SPR); 2=rel(1-SPR_MSY); 3=rel(1-SPR_Btarget); 4=no denominator (report actural 1-SPR values)
```

1 # F_std reporting: 0=skip; 1=exploit(Bio); 2=exploit(Num); 3=sum(frates)
0 # F_report_basis: 0=raw; 1=rel Fspr; 2=rel Fmsy ; 3=rel Fbtgt

999 # check value for end of file

Forecast file

```
##  SS3 Version 3.20
# for all year entries except rebuilder; enter either: actual year, -999 for styr, 0 for endyr, neg number for rel. endyr
1			# Benchmarks: 0=skip; 1=F(SPR); 2=F(MSY);3=F(Btarget); 4=F(endyr); 5=Ave recent F (not implemented); 6= read Fmult (not implemented)
2			# MSY: 1= set to F(SPR); 2=calc F(MSY); 3=set to F(Btgt); 4=set to F(endyr)
0.5	# SPR target (e.g. 0.40), 0.5 for west coast groundfish
0.4	# Biomass target (e.g. 0.40)
#_Bmark_years: beg_bio, end_bio, beg_selex, end_selex, beg_relF, end_relF (enter actual year, or values of 0 or -integer to be rel. endyr)
0 0 0 0 0 0
2 #Bmark_relF_Basis: 1 = use year range; 2 = set relF same as forecast below

1	# Forecast: 0=none; 1=F(SPR); 2=F(MSY) 3=F(Btgt); 4=F(endyr); 5=Ave F (enter yrs); 6=read Fmult
12	# N foreast year
1	# F scaler (only used for Do_Forecast==5)
#_Fcast_years:  beg_selex, end_selex, beg_relF, end_relF  (enter actual year, or values of 0 or -integer to be rel. endyr)
0 0 -10 0
1			# Control rule method (1=catch=f(SSB) west coast; 2=F=f(SSB) )
0.04	# Control rule Biomass level for constant F (as frac of Bzero, e.g. 0.40)
0.01	# Control rule Biomass level for no F (as frac of Bzero, e.g. 0.10)
#0.956	# Control rule target as fraction of Flimit (e.g. 0.75)
1
3			#_N forecast loops (1-3) (fixed at 3 for now)
3			#_First forecast loop with stochastic recruitment
0			#_Forecast loop control #3 (reserved for future bells&whistles)
0			#_Forecast loop control #4 (reserved for future bells&whistles)
0			#_Forecast loop control #5 (reserved for future bells&whistles)
2007	#FirstYear for caps and allocations (should be after years with fixed inputs)
0.0			# stddev of log(realized catch/target catch) in forecast (set value>0.0 to cause active impl_error) (if=0, there will be N_forecase_years less
parameters estimated)
0			# Do West Coast gfish rebuilder output (0/1)
-1			# Rebuilder:  first year catch could have been set to zero (Ydecl)(-1 to set to 1999)
-1			# Rebuilder:  year for current age structure (Yinit) (-1 to set to endyear+1)
1			# fleet relative F:  1=use first-last alloc year; 2=read seas(row) x fleet(col) below
# Note that fleet allocation is used directly as average F if Do_Forecast=4
2			# basis for fcast catch tuning and for fcast catch caps and allocation  (2=deadbio; 3=retainbio; 5=deadnum; 6=retainnum)
```

Conditional input if relative F choice = 2
Fleet relative F: rows are seasons, columns are fleets
max totalcatch by fleet (-1 to have no max) must enter value for each fleet
-1 -1 -1 -1
max totalcatch by area (-1 to have no max); must enter value for each fleet
-1
fleet assignment to allocation group (enter group ID# for each fleet, 0 for not included in an alloc group)
0 0 0 0
#_Conditional on >1 allocation group
allocation fraction for each of: 0 allocation groups
no allocation groups
48 # Number of forecast catch levels to input (else calc catch from forecast F)
2 # basis for input Fcast catch: 2=dead catch; 3=retained catch; 99=input Hrate(F) (units are from fleetunits; note new codes in SSV3.20)
Input fixed catch values

#year	season	fishery	OFL
2015	1	1	1724.337991
2015	1	2	3.922547609
2015	1	3	0
2015	1	4	29.33946143
2016	1	1	1715.508313
2016	1	2	3.902461737
2016	1	3	0
2016	1	4	29.18922523
2017	1	1	2876.35588
2017	1	2	6.543173636
2017	1	3	0
2017	1	4	48.94094595
2018	1	1	2766.68147
2018	1	2	6.293684789
2018	1	3	0
2018	1	4	47.07484536
2019	1	1	2720.031338
2019	1	2	6.187564432
2019	1	3	0
2019	1	4	46.28109742

2020	1	1	2675.461086
2020	1	2	6.086175414
2020	1	3	0
2020	1	4	45.52273844
2021	1	1	2615.20344
2021	1	2	5.949100497
2021	1	3	0
2021	1	4	44.49745981
2022	1	1	2546.224034
2022	1	2	5.792185202
2022	1	3	0
2022	1	4	43.3237812
2023	1	1	2476.862008
2023	1	2	5.63439952
2023	1	3	0
2023	1	4	42.14359235
2024	1	1	2411.855957
2024	1	2	5.486522867
2024	1	3	0
2024	1	4	41.03752002
2025	1	1	2353.177842
2025	1	2	5.353041089
2025	1	3	0
2025	1	4	40.03911698
2026	1	1	2301.161228
2026	1	2	5.234712986
2026	1	3	0
2026	1	4	39.15405881
999	# verify end of input		

Data File

```
# *************************************************************
#  Chilipepper rockfish .dat file
#  final model May 2015 assessment update
# SS3 Version 3.20 by_Richard_Methot_(NOAA);_using_Otter_Research_ADMB_7.0.1
# *************************************************************
#

1892	#_start year
2014	#_end year
1		#_number of seasons per year
12		# vector with N months in each season
1		#_spawning occurs at the beginning of this season
4		#_number of fishing fleets
6		#_number of surveys
1		#_N_areas

# string containing names for all fisheries and
# surveys, delimited by the % character
trawl%hookline%setnet%rec%triennial%combined%juv%juvenile%juv2%ghost

# fraction of season elapsed before CPUE measured or survey conducted
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	0.5	0.5		#_Catch or survey timing_in_season
1	1	1	1	1	1	1	1	1	1		#_area_assignments_for_each_fishery_and_survey

# Fishery information
1		1  1		1		#_units of catch:  1=bio; 2=num
0.05	0.05	0.05	0.05	#_se of log(catch) only used for init_eq_catch and for Fmethod 2 and 3; use -1 for discard only fleets

2	# number of genders
21	# accumulator age

#_initial equilibrium catch for each fishery
0	0	0	0	# init equil
```

123		#_N_lines_of_catch_to_read			
#trawl	hook.line		setnet	recreational	
11	206	0	0	1892	1
10	195	0	0	1893	1
10	183	0	0	1894	1
9	171	0	0	1895	1
9	162	0	0	1896	1
8	152	0	0	1897	1
8	143	0	0	1898	1
7	133	0	0	1899	1
8	147	0	0	1900	1
8	161	0	0	1901	1
9	176	0	0	1902	1
10	190	0	0	1903	1
11	204	0	0	1904	1
11	218	0	0	1905	1
12	232	0	0	1906	1
13	246	0	0	1907	1
14	260	0	0	1908	1
15	292	0	0	1909	1
17	325	0	0	1910	1
19	358	0	0	1911	1
21	390	0	0	1912	1
22	423	0	0	1913	1
24	455	0	0	1914	1
26	488	0	0	1915	1
28.86	694.83	0	0	1916	1
44.84	1104.04	0	0	1917	1
52.47	1123.49	0	0	1918	1
36.51	722.48	0	0	1919	1
37.23	760.66	0	0	1920	1
30.73	646.96	0	0	1921	1
26.43	598.27	0	0	1922	1
28.55	732.43	0	0	1923	1

16.42	763.79	0	0	1924	1
13.48	864.75	0	0	1925	1
40.31	1149.06	0	0	1926	1
73.78	943.18	0	0	1927	1
94.7	903.91	0	1.73	1928	1
112.01	855.24	0	3.46	1929	1
117.2	973.19	0	4.17	1930	1
80.45	1079.43	0	5.55	1931	1
95.61	733.51	0	6.94	1932	1
146.24	508.41	0	8.33	1933	1
140.92	553.22	0	9.72	1934	1
125.66	617.27	0	11.11	1935	1
133.36	422.47	0	12.22	1936	1
161.54	341.48	0	16.33	1937	1
136.39	334.8	0	15.46	1938	1
141.24	388.17	0	13.47	1939	1
111.67	363.62	0	16.83	1940	1
86.55	328	0	15.55	1941	1
22.44	147.05	0	8.26	1942	1
233.7	139.8	0	7.9	1943	1
878.61	216.29	0	6.49	1944	1
1852.83	421.93	0	8.65	1945	1
1445.58	298.17	0	14.89	1946	1
935.13	364.1	0	17.17	1947	1
562.03	404.97	0	40.72	1948	1
725.82	353.72	0	52.73	1949	1
963.53	446.11	0	54.85	1950	1
1177.06	500.41	0	55.93	1951	1
885.53	258.65	0	62.16	1952	1
1118.92	248.53	0	59.79	1953	1
965.36	311.76	0	101.01	1954	1
1508.65	414	0	140.43	1955	1
1155.92	300.92	0	162.88	1956	1
1640.19	335.63	0	130.25	1957	1
1450.82	372.02	0	130.19	1958	1

1243.68	297.44	0	93.84	1959	1
1191.18	424.67	0	97.26	1960	1
653.35	346.45	0	82.47	1961	1
555.56	377.53	0	94.67	1962	1
1157.15	502.58	0	80.01	1963	1
913.16	418.89	0	105.14	1964	1
986.63	407.54	0	116.56	1965	1
2025.99	320.03	0	183.29	1966	1
2602.08	285.98	0	193.61	1967	1
1421.98	193.67	0	202.41	1968	1
708.53	43.55	0	207.55	1969	1
843.29	40.28	0	279.41	1970	1
726.58	50.44	0	237.85	1971	1
1077.91	78.54	0	284.23	1972	1
2494.42	72.58	0	362.34	1973	1
2843.4	110.49	0	437.45	1974	1
2421.96	86.62	0	397.98	1975	1
2415.36	123.37	0	373.03	1976	1
1867.8	100.66	0	324.21	1977	1
1292.87	194.95	25.83	313.73	1978	1
2003.15	230.73	54.19	448.1	1979	1
2744.26	95.87	45.38	255.89	1980	1
2317.83	139.13	71.28	272.22	1981	1
1690.53	356.35	85.42	389.02	1982	1
1881.55	80.23	345.21	162.08	1983	1
2449.75	98.1	231.04	155.19	1984	1
1808.16	278.99	738.69	391.4	1985	1
1269.64	330.88	1161.46	394.75	1986	1
1314.05	172.61	461.11	117.27	1987	1
1782.41	333.47	289.36	384.63	1988	1
2365.6	425.58	361.37	285.69	1989	1
2331.2	232.12	372.77	219.9	1990	1
2242.12	618.32	332.08	154.1	1991	1
1335.89	1052.67	296.72	88.31	1992	1
1296.02	860.86	232.91	22.51	1993	1

1276.62	484.99	107.71	21.43	1994	1
1603.88	324.9	94.05	10.87	1995	1
1535.38	254.23	57.67	32.84	1996	1
1619.77	339.29	82.97	73.64	1997	1
1141.27	208.84	77.62	7.28	1998	1
839.31	104.18	9.67	24.51	1999	1
536.08	50.6	6.11	39.21	2000	1
435.87	25.18	4.9	51.87	2001	1
300.73	6.22	0.42	12.62	2002	1
20.33	0.25	0.05	0.01	2003	1
145	2	0	6	2004	1
76	3	0	6	2005	1
124.3	0	0	1.6	2006	1
125	4	0	8	2007	1
145	0	0	3	2008	1
314.8	0.6	0	2.1	2009	1
394.12	0.18	0	2.79	2010	1
325.32	0.71	0	5.02	2011	1
298.45	1.17	0	7.74	2012	1
397.21	0.94	0	7.25	2013	1
316.91	0.94	0	6.67	2014	1

Abundance indices
63 # number of observations

#_Units: 0=numbers; 1=biomass; 2=F
#_Errtype: -1=normal; 0=lognormal; >0=T
#_Fleet Units Errtype
1 1 0
2 1 0
3 1 0
4 1 0
5 1 0
6 1 0
7 1 0

8 1 0
9 1 0
10 0 0

#year	season	type	value	SD
1980	1	1	249	0.25
1981	1	1	150	0.25
1982	1	1	121	0.25
1983	1	1	116	0.25
1984	1	1	91	0.25
1985	1	1	88	0.25
1986	1	1	76	0.25
1987	1	1	116	0.25
1988	1	1	158	0.25
1989	1	1	172	0.25
1990	1	1	149	0.25
1991	1	1	146	0.25
1992	1	1	109	0.25
1993	1	1	80	0.25
1994	1	1	112	0.25
1995	1	1	126	0.25
1996	1	1	96	0.25

#
triennial GLM tuned

1980	1	5	3954.37	1.625
1983	1	5	1994.42	0.613
1986	1	5	1166.33	1.213
1989	1	5	2400.58	0.300
1992	1	5	368.77	0.581
1995	1	5	1545.10	0.264
1998	1	5	945.46	0.341
2001	1	5	806.63	0.285
2004	1	5	2157.54	0.254

#NWC combo survey glm tuned

#2003	1	6	3932	0.61654
#2004	1	6	24559	1.19248
#2005	1	6	9540	0.4466
#2006	1	6	7384	0.40252

#new.index

2003	1	6	84198.01909	0.295756252
2004	1	6	148524.7909	0.315046881
2005	1	6	172935.2143	0.3039165
2006	1	6	89442.99718	0.344710154
2007	1	6	87020.10752	0.336344769
2008	1	6	51589.24928	0.303109767
2009	1	6	58430.6456	0.304917031
2010	1	6	68688.831	0.271744734
2011	1	6	66377.24644	0.314254431
2012	1	6	96084.09041	0.291915674
2013	1	6	106867.0214	0.288733564
2014	1	6	120686.8358	0.25839602

juvenile survey- FED

#year	season	type	value	SD
#2001	1	8	1.7161	0.0401
#2002	1	8	2.7629	0.0451
#2003	1	8	1.5719	0.0367
#2004	1	8	2.9379	0.0360
#2005	1	8	0.8658	0.0346
#2006	1	8	0.7523	0.0301

juvenile survey- FED

#year	season	type	value	SD
2001	1	8	2.25776	0.48388
2002	1	8	5.21742	0.48574
2003	1	8	2.35769	0.44485
2004	1	8	3.63883	0.35855
2005	1	8	1.3791	0.36056
2006	1	8	1.51723	0.36088

2007	1	8	1.38526	0.38096	
2008	1	8	1.8446	0.39339	
2009	1	8	2.79921	0.40496	
2010	1	8	5.86269	0.56904	
2012	1	8	2.73777	0.58768	
2013	1	8	382.993	0.55651	
2014	1	8	52.190	0.57157	
#					
#					
# CalCOFI survey					
#year	season	type	Index	CV	
# rec cpue					
#year	season	type	index	jack.cv	
1987	1	10	0.166856206		0.1631351
1988	1	10	0.083010716		0.1794928
1989	1	10	0.054122438		0.1633441
1990	1	10	0.031462634		0.4267126
1991	1	10	0.040173333		0.3545357
1992	1	10	0.064866103		0.5545214
1993	1	10	0.026517113		0.2333201
1994	1	10	0.023850668		0.2796596
1995	1	10	0.024610012		0.4197283
1996	1	10	0.015093027		0.4449115
1997	1	10	0.008328447		0.3430329
1998	1	10	0.006612019		0.421573

DISCARD BIOMASS currently I have no discard data
0 #_1=biomass(mt) discarded; 2=fraction of total catch discarded
0 #_number of observations
#

#_MEAN BODY WEIGHT
#_-----------------
0 #_number of observations

```
30	#_DF_for_meanbodywt_T-distribution_like
1	# length bin method: 1=use databins; 2=generate from width, min,max below; 3=read nbins, then vector
#

# COMPOSITION CONDITIONERS
# ------------------------
-1	# negative value causes no compression
0.0001	#_constant added to proportions at length & age (renormalized to sum to 1 after constant is added)
0	#_combine males into females at or below this bin number
#

#_LENGTH COMPOSITION
#_------------------
#_vector containing lower edge of length bins
19	#_number of length bins
16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
	52

# note: new SS3 reading error if nsample is negative, use negative year in new SS3
140	#_number of lines of length comp observations

#
# Trawl fishery		Females first, then males				females
								males

#year	season	type	gender	partition	# samples		16	18	20	22	24	26	28	30	32	34	36
	38	40	42	44	46	48	50	52	16	18	20	22	24	26	28	30	32
	34	36	38	40	42	44	46	48	50	52
# LFs seemed to differ between aged and unaged comps- so LFs turned off
1978	1	1	3	0	147	0.00022	0	0	0.01818	0.00388	0.00229	0.00744	0.01194	0.04564	0.05786	0.04806	0.05182
	0.07637	0.10655	0.05257	0.04429	0.07482	0.01717	0.01018	0	0	0	0.00021	0.00069	0.00102	0.01447	0.05906	0.18275	0.04776
	0.04849	0.01021	0.00039	0	0.00018	0.00121	0	0.00429	0
1979	1	1	3	0	110	0	0	0.00049	0	0.00004	0.00132	0.02087	0.0092	0.01246	0.04269	0.03287	0.03745
	0.1193	0.066	0.17126	0.10614	0.08089	0.00735	0.00528	0	0	0	0	0.00041	0.00095	0.00821	0.04017	0.0724	0.06751
	0.05974	0.03585	0.00011	0.00001	0.0008	0	0.00008	0.00017	0
```

1980	1	1	3	0	191	0	0	0.00039	0	0	0.00349	0.00287	0.0041	0.02768	0.05072	0.06043	0.1232
	0.09582	0.10987	0.08439	0.07823	0.03707	0.0149	0.00063	0	0	0	0	0.00342	0.00256	0.00799	0.03147	0.08474	0.09921
	0.04584	0.01837	0.00273	0.00223	0.00025	0.00042	0.0066	0.00008	0.0003								
1981	1	1	3	0	125	0	0	0	0	0	0.00088	0.00667	0.00529	0.01266	0.01064	0.09861	0.2005
	0.09316	0.10213	0.0487	0.07159	0.04917	0.00273	0.00009	0	0	0	0	0	0.00064	0.00026	0.04874	0.11222	0.12205
	0.0119	0.00084	0.00005	0.00046	0	0.00002	0	0	0								
1982	1	1	3	0	195	0	0	0	0.00035	0.00022	0.00067	0.00525	0.01354	0.01678	0.0125	0.06505	0.08043
	0.13048	0.18373	0.15391	0.076	0.03757	0.01085	0.00174	0	0	0	0.00078	0.00005	0.00359	0.00727	0.02841	0.07633	0.06915
	0.02099	0.00408	0.00023	0.00006	0	0	0	0	0								
1983	1	1	3	0	275	0	0	0	0	0.0002	0.00113	0.00338	0.01176	0.01812	0.01728	0.02633	0.03683
	0.13454	0.20614	0.14642	0.11552	0.07491	0.02504	0.00759	0	0	0	0.00004	0.0001	0.00066	0.00736	0.03449	0.03921	0.05539
	0.02184	0.00391	0.00018	0.00244	0.00191	0.00005	0.00001	0.00007	0.00715								
1984	1	1	3	0	305	0	0	0	0.00003	0.00006	0.00369	0.00333	0.01501	0.05746	0.08824	0.16352	0.06524
	0.10441	0.07823	0.06725	0.04769	0.02093	0.00477	0.0017	0.00002	0	0	0	0.00009	0.00102	0.02879	0.03878	0.0771	0.06447
	0.05422	0.00792	0.00032	0.00166	0.00061	0.00242	0.00049	0.00052	0.00002								
1985	1	1	3	0	338	0	0	0	0.001	0.00035	0.00128	0.00832	0.02207	0.04019	0.06271	0.08883	0.11605
	0.06376	0.05989	0.07079	0.04972	0.02535	0.00534	0.00193	0	0	0	0.00009	0.00011	0.00232	0.01902	0.06599	0.10678	0.1175
	0.04632	0.01314	0.00603	0.00042	0.00045	0.00138	0.0015	0.00138	0								
1986	1	1	3	0	219	0.00044	0.0001	0	0.00022	0.00009	0.00458	0.00832	0.02425	0.0379	0.0594	0.07245	0.09209
	0.07529	0.05696	0.07571	0.06683	0.03424	0.03705	0.00078	0	0.00004	0	0.00093	0.0034	0.00564	0.01592	0.09321	0.10176	0.06953
	0.03448	0.01659	0.00662	0.00095	0	0.0018	0.00244	0	0								
1987	1	1	3	0	211	0.00016	0	0.00012	0.00003	0.00189	0.01545	0.07235	0.16683	0.09549	0.04457	0.03733	0.04516
	0.04761	0.04209	0.0179	0.00896	0.00521	0.00057	0.00056	0	0	0	0	0.00112	0.04064	0.1188	0.06182	0.08213	0.06136
	0.02295	0.00782	0.00086	0.00019	0.00001	0.00001	0	0	0								
1988	1	1	3	0	199	0	0	0	0	0.00003	0.01118	0.03265	0.08052	0.0893	0.10642	0.08444	0.01661
	0.03359	0.05067	0.02813	0.01291	0.00676	0.00425	0.0009	0	0	0	0.00003	0.00014	0.04746	0.12885	0.10265	0.08427	0.0428
	0.03387	0.00139	0	0.00016	0.00001	0	0	0	0								
1989	1	1	3	0	183	0.00007	0	0	0	0.00207	0.00491	0.0133	0.01524	0.05436	0.09059	0.13372	0.17294
	0.02935	0.01437	0.01396	0.00704	0.00758	0.00131	0	0	0	0	0.00096	0.00612	0.00994	0.0414	0.15366	0.12776	0.06141
	0.03496	0.00173	0.00017	0.00098	0	0.00009	0	0	0								
1990	1	1	3	0	204	0.00001	0	0.00006	0	0.00355	0.00738	0.03629	0.04755	0.04567	0.04607	0.06876	0.14846
	0.10491	0.043	0.03709	0.00822	0.00432	0.00119	0.00018	0	0	0	0	0.00195	0.02245	0.05403	0.08982	0.12547	0.04891
	0.04953	0.004	0.00087	0	0.00021	0	0.00002	0.00005	0								

1991 1 1 3 0 208 0.00017 0 0.0005 0.00091 0.00456 0.01515 0.02599 0.05384 0.08291 0.06996 0.06904 0.07213
0.07997 0.04056 0.03088 0.01192 0.0107 0.00363 0.00104 0 0 0.00015 0.00013 0.00662 0.01265 0.05956 0.10457 0.13979 0.06707
0.02766 0.00608 0.00157 0 0.00009 0 0.0002 0 0
1992 1 1 3 0 132 0 0 0 0.00005 0.00405 0.0288 0.05881 0.09328 0.08427 0.06824 0.04726 0.07089
0.06935 0.07266 0.04536 0.03254 0.02026 0.00379 0 0 0 0.00001 0.00008 0.00384 0.02468 0.03734 0.0624 0.08162 0.05922
0.01503 0.00609 0.00293 0.00213 0.00284 0.00075 0.00142 0 0
1993 1 1 3 0 126 0 0.00012 0.00001 0.00064 0.00864 0.01402 0.05882 0.16809 0.08456 0.08385 0.08023 0.05142
0.04641 0.04061 0.02042 0.00764 0.00506 0.00094 0 0 0 0 0.00203 0.00957 0.06125 0.11245 0.07924 0.04639 0.01194
0.00498 0.00006 0 0 0 0 0 0.0006 0
1994 1 1 3 0 117 0 0 0 0 0.00167 0.0112 0.02259 0.02581 0.04153 0.06489 0.1126 0.06874
0.07034 0.05595 0.05194 0.02649 0.01075 0.00073 0.0009 0 0 0 0 0.00184 0.04468 0.08946 0.12132 0.0972 0.06042
0.01519 0.0029 0.00021 0.00068 0 0 0 0 0
1995 1 1 3 0 114 0 0 0 0.00035 0.00078 0.00111 0.00893 0.03026 0.05741 0.05007 0.08525 0.12008
0.09374 0.06827 0.0388 0.02381 0.00884 0.00242 0.00119 0.00175 0 0 0.00205 0 0.01412 0.03783 0.08782 0.14094 0.0774
0.03078 0.00468 0.00073 0.00171 0.00223 0.0049 0 0 0.00175
1996 1 1 3 0 116 0 0 0 0.00033 0.00445 0.03196 0.08891 0.08369 0.0443 0.04167 0.05217 0.04535
0.06299 0.06357 0.01947 0.01333 0.00335 0.00023 0.00019 0 0 0 0.00168 0.01966 0.10183 0.10599 0.06959 0.07843 0.0509
0.01033 0.00186 0.00194 0.0005 0.00132 0 0 0 0
1997 1 1 3 0 136 0 0 0 0.00077 0.00202 0.00216 0.02881 0.12925 0.10512 0.03317 0.02917 0.05403
0.05664 0.04962 0.04472 0.01526 0.00855 0.0007 0.00001 0 0 0 0.0033 0.00045 0.06268 0.14975 0.09977 0.06919 0.02845
0.01467 0.00857 0.0001 0.00137 0.00127 0.00042 0 0 0
#
1998 1 1 3 0 123 0 0 0 0 0.00397 0.01444 0.0224 0.03925 0.06226 0.09141 0.0686 0.06555
0.07515 0.05957 0.04919 0.03089 0.00886 0.00108 0.0018 0 0 0 0 0.04411 0.01694 0.06933 0.12133 0.08988 0.03285
0.02736 0.00183 0.00042 0.0005 0.00085 0.00014 0.00003 0.00001 0
1999 1 1 3 0 84 0.00047 0.00112 0 0 0.00036 0.00233 0.03304 0.08849 0.0807 0.03665 0.06671 0.08052
0.05581 0.07201 0.05503 0.04537 0.01173 0.00715 0.00016 0 0 0 0 0.00011 0.03147 0.08443 0.10657 0.07571 0.04674
0.01023 0.00673 0 0.00002 0.00035 0 0 0 0
2000 1 1 3 0 50 0 0 0 0.00228 0.00019 0.00019 0.00928 0.01157 0.02875 0.05166 0.05578 0.11252
0.10642 0.09753 0.11272 0.08519 0.03014 0.00908 0.00308 0.00002 0 0 0.00031 0 0.01031 0.02243 0.0715 0.0666 0.07021
0.0207 0.01719 0.0016 0.00051 0.00101 0.00089 0.00033 0 0
2001 1 1 3 0 58 0 0 0 0.0083 0.01993 0.00771 0.01187 0.01642 0.03758 0.0536 0.05483 0.06074
0.05892 0.10988 0.03332 0.05608 0.0312 0.0132 0.05663 0 0 0 0.01426 0.02615 0.01599 0.02994 0.0876 0.10742 0.0699
0.01551 0.0022 0.00032 0 0.0004 0 0 0 0.00011

2002	1	1	3	0	54	0	0.00586	0.00114	0.00864	0.03363	0.07192	0.09017	0.0404	0.02739	0.0244	0.01947	0.05204
	0.05112	0.08519	0.0902	0.07081	0.04005	0.00877	0.00706	0.00113	0.00452	0.00124	0.0041	0.02706	0.07152	0.02883	0.03737	0.03884	0.03246
	0.01081	0.00224	0.00322	0.00246	0.00284	0	0	0.00083	0.0023								
2003	1	1	3	0	18	0	0	0	0.00218	0.00084	0.00031	0.00632	0.19441	0.31227	0.10404	0.01206	0.00536
	0.00727	0.01577	0.01604	0.00329	0.00214	0	0.00096	0	0.00023	0.00011	0.00084	0.00011	0.07587	0.12785	0.0586	0.02396	0.02086
	0.00712	0.00119	0	0	0	0	0	0	0								
2004	1	1	3	0	54	0	0	0	0.00012	0.00048	0.00063	0.00095	0.00524	0.02633	0.21118	0.27406	0.05632
	0.01742	0.03838	0.05902	0.04136	0.02919	0.0043	0	0	0	0	0.00023	0.00058	0.00026	0.02585	0.10078	0.07134	0.02827
	0.00561	0.00212	0	0	0	0	0	0	0								
2005	1	1	3	0	20	0	0	0	0.00095	0	0	0	0.01986	0.0208	0.00037	0.06466	0.3323
	0.18004	0.04388	0.04495	0.02574	0.01096	0	0	0	0	0	0	0	0	0.06488	0.12996	0.03707	0.00865
	0.00543	0	0.00949	0	0	0	0	0	0								

new to update assessment

#year	season	type	gender	part	#samp	16	18	20	22	24	26	28	30	32	34	36	38
	40	42	44	46	48	50	52	16	18	20	22	24	26	28	30	32	34
	36	38	40	42	44	46	48	50	52								
2006	1	1	3	0	28	0	0	0	0	0	0	0	0.00128	0.00403	0.00696	0.01185	0.07985
	0.21999	0.18547	0.26428	0.05523	0.02004	0.00501	0.00513	0	0	0	0	0	0	0.00006	0.0058	0.0479	0.06867
	0.01833	0	0.00012	0	0	0	0	0	0								
2007	1	1	3	0	30	0	0.00007	0	0	0	0	0.00078	0.00213	0.00341	0.00683	0.00292	0.04219
	0.08381	0.11369	0.0429	0.01665	0.00548	0.00149	0.00014	0	0	0	0	0	0	0.00178	0.00213	0.02924	0.06182
	0.1149	0.01615	0.09078	0.22553	0.12009	0.01508	0	0	0								
2008	1	1	3	0	52	0	0	0	0	0	0	0.00017	0.00455	0.02146	0.0105	0.04584	0.06877
	0.17524	0.36671	0.15241	0.01787	0.00584	0.00013	0.00043	0	0	0	0	0	0.00019	0.00884	0.00746	0.0265	0.03517
	0.00484	0.00399	0.00627	0.02021	0.0139	0	0.00272	0	0								
2009	1	1	3	0	51	0	0	0	0	0	0	0	0.02281	0.16014	0.13279	0.0812	0.06143
	0.07439	0.11706	0.09248	0.04629	0.02826	0.00383	0	0	0	0	0	0	0.00305	0.0134	0.05116	0.07145	0.0387
	0.00156	0	0	0	0	0	0	0	0								
2010	1	1	3	0	41	0	0	0	0	0	0	0	0.00725	0.01785	0.04414	0.04789	0.02832
	0.1154	0.23989	0.3425	0.06672	0.01578	0.00391	0	0	0	0	0	0	0.00009	0.0026	0.01836	0.0206	0.01897
	0.00924	0.00051	0	0	0	0	0	0	0								
2012	1	1	3	0	34	0	0	0	0.00003	0	0.00009	0.01332	0.01227	0.02472	0.01612	0.00373	0.12329
	0.14518	0.14506	0.16249	0.09472	0.01065	0	0	0	0	0	0.00096	0.00402	0.00043	0.00877	0.04394	0.07715	0.07226
	0.04073	0	0.00006	0	0	0	0	0	0								

2013	1	1	3	0	34	0	0	0	0.00005	0.00355	0.00581	0.003	0.04751	0.09696	0.02696	0.00942	0.00966
	0.16413	0.1711	0.17901	0.10856	0.01655	0.00021	0.00226	0	0	0	0.00069	0.00133	0.00771	0.01637	0.02858	0.03985	0.03338
	0.02319	0.00133	0.0007	0.00214	0	0	0	0	0								
2014	1	1	3	0	27	0	0	0	0	0	0.00039	0.00979	0.03044	0.03263	0.05349	0.0165	0.00665
	0.02658	0.17088	0.25166	0.24853	0.09171	0.00006	0.0041	0	0	0	0	0	0.00425	0.02035	0.00865	0.01468	0.00438
	0.00017	0	0	0	0	0.0041	0	0	0								
#																	
# Hook and line fishery								females									
									males								
#year	season	type	gender	partition	# samples		16	18	20	22	24	26	28	30	32	34	36
	38	40	42	44	46	48	50	52	16	18	20	22	24	26	28	30	32
	34	36	38	40	42	44	46	48	50	52							
1980	1	2	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0.05346
	0.0004	0.0002	0.10731	0.21581	0.62144	0.0004	0	0	0	0	0	0	0	0	0	0	0
	0.0002	0	0	0	0	0.0002	0.0004	0	0								
1982	1	2	3	0	20	0	0	0	0	0	0	0	0	0	0	0	0.02656
	0.07327	0.14654	0.35618	0.19872	0.17263	0.02609	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0								
1983	1	2	3	0	8	0	0	0	0	0	0	0	0	0	0	0	0.01666
	0.14961	0.06663	0.09964	0.26559	0.38521	0	0	0	0	0	0	0	0	0	0	0.01666	0
	0	0	0	0	0	0	0	0	0								
1984	1	2	3	0	9	0	0	0	0	0	0	0	0	0	0	0	0.05882
	0.11765	0.17647	0.23529	0.17647	0.17647	0	0.05882	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0								
1985	1	2	3	0	14	0	0	0	0	0	0	0	0	0	0.00023	0.0222	0.10922
	0.15438	0.09717	0.3143	0.15556	0.0774	0.01025	0	0	0	0	0	0	0	0	0	0.01315	0.02107
	0.0246	0	0	0	0.00047	0	0	0	0								
1986	1	2	3	0	8	0	0	0	0	0	0	0	0.00138	0	0.00204	0.00836	0.02555
	0.14258	0.10739	0.35049	0.17396	0.11928	0.04642	0.0002	0	0	0	0	0	0	0.00003	0	0	0.01824
	0.0004	0	0	0.00191	0	0.00178	0	0	0								

1987	1	2	3	0	9	0	0	0	0	0	0	0.00657	0.02064	0.0066	0	0.05516	0.17066
	0.23488	0.1451	0.10775	0.05923	0.1022	0.00734	0.00004	0	0	0	0	0	0	0.00319	0.00657	0.00657	0.00319
	0	0.06432	0	0	0	0	0	0	0								
1989	1	2	3	0	16	0	0	0	0	0	0	0	0	0.03538	0.08849	0.08298	0.02435
	0.0592	0.01779	0.01218	0.01826	0.02435	0	0	0	0	0	0	0	0	0.01769	0.08846	0.05308	0.33615
	0.12388	0.01769	0	0.00007	0	0	0	0	0								
1990	1	2	3	0	16	0	0	0	0	0	0	0	0.00205	0	0.05716	0.16326	0.58683
	0.16725	0	0.0032	0.00326	0	0	0	0	0	0	0	0	0	0	0.00483	0	0.00526
	0.00689	0	0	0	0	0	0	0	0								
1991	1	2	3	0	41	0	0.00143	0	0	0.00003	0.01129	0.00118	0.01025	0.06023	0.08648	0.19366	0.08308
	0.15067	0.07261	0.05628	0.01759	0.00397	0.00164	0	0	0	0	0	0.00003	0.00045	0.02487	0.04852	0.09975	0.06582
	0.00883	0.00088	0.00025	0.00019	0	0	0	0	0								
1992	1	2	3	0	84	0	0	0	0	0	0.00081	0.00155	0.03048	0.03815	0.08563	0.08881	0.1549
	0.11131	0.13644	0.08134	0.03369	0.01247	0.00425	0	0	0	0	0	0	0.00315	0.01819	0.07305	0.05973	0.05016
	0.01027	0.00158	0.00079	0.00311	0	0	0	0	0								
1993	1	2	3	0	87	0	0	0.00036	0	0	0.0251	0.10349	0.25814	0.18048	0.14098	0.08223	0.05605
	0.00957	0.0072	0.0021	0.001	0.00086	0	0	0	0	0	0.00036	0.01122	0.02667	0.02754	0.02959	0.03582	0.00116
	0.00007	0	0	0	0	0	0	0	0								
1994	1	2	3	0	86	0	0	0	0	0	0	0	0.00284	0.01322	0.04427	0.08209	0.16641
	0.19531	0.21998	0.08578	0.03136	0.03328	0.00023	0	0	0	0	0	0	0	0	0.03582	0.05304	0.02098
	0.00407	0.0113	0	0	0	0	0	0	0								
1995	1	2	3	0	23	0	0	0	0	0	0	0	0.02018	0.02427	0.02279	0.10374	0.2622
	0.10859	0.0662	0.02693	0.0042	0.00013	0	0	0	0	0	0	0	0	0.01229	0.03623	0.0747	0.04455
	0.06782	0.05856	0.03752	0.00387	0.01682	0	0	0	0								
1996	1	2	3	0	41	0	0	0	0	0	0	0.01667	0.0016	0.01394	0.08846	0.1179	0.22555
	0.21468	0.07447	0.04815	0.03936	0.00221	0.00204	0	0	0	0	0	0	0	0	0.01948	0.05499	0.06521
	0.00247	0.01121	0	0.0016	0	0	0	0	0								
1997	1	2	3	0	38	0	0	0	0	0.00215	0.00078	0	0.01598	0.08748	0.09409	0.08517	0.14414
	0.19467	0.10841	0.07685	0.04188	0.01266	0.00378	0	0	0	0	0	0	0.00303	0.03014	0.04673	0.02531	0.02327
	0.00078	0.00239	0.00003	0.00027	0	0	0	0	0								
1998	1	2	3	0	38	0.00326	0	0	0	0	0	0.00563	0.0064	0.03196	0.13658	0.09991	0.06159
	0.11968	0.13457	0.07747	0.04899	0.00844	0.00774	0.00391	0	0	0	0	0.00461	0.00326	0.00226	0.06047	0.09318	0.07127
	0.01461	0.00047	0	0.00372	0	0	0	0	0								

1999	1	2	3	0	11	0	0	0	0	0	0	0	0.02659	0.06492	0.07368	0.17232	0.24041
	0.09193	0.11931	0.06458	0.02409	0.00238	0	0	0	0	0	0	0	0.00467	0.00517	0.02843	0.04026	0.02993
	0.01134	0	0	0	0	0	0	0	0								
# samp size for hook lengths from 1997 through 2001 set neg. as length comps for aged and unaged fish somewhat different..																	
2000	1	2	3	0	9	0	0	0	0	0	0.00031	0.00031	0.01411	0.02543	0.13084	0.25728	0.12122
	0.16961	0.077	0.05276	0.0226	0.02131	0	0	0	0	0	0	0	0.00031	0.01034	0.01534	0.04837	0.02074
	0.00626	0	0	0.00587	0	0	0	0	0								
2001	1	2	3	0	12	0	0	0	0	0	0	0	0.00132	0	0.01175	0.03414	0.0829
	0.11837	0.1749	0.12195	0.05119	0.02052	0.01335	0	0	0	0	0	0	0	0.01026	0.06216	0.17562	0.10756
	0.01241	0	0	0.0016	0	0	0	0	0								
2002	1	2	3	0	3	0	0	0	0	0	0.02632	0.10526	0	0	0	0	0.02632
	0	0	0.05263	0.02632	0.02632	0	0	0	0	0	0	0.02632	0.02632	0	0.15789	0.39474	0.13158
	0	0	0	0	0	0	0	0	0								
2006	1	2	3	0	3	0	0	0	0	0	0	0	0	0	0.01272	0	0.16185
	0.23815	0.25318	0.10867	0.05549	0.10636	0	0	0	0	0	0	0	0	0	0	0.02543	0
	0	0	0.02543	0.01272	0	0	0	0	0								
# new to update assessment																	
#year	season	type	gender	partition	# samples												
2007	1	2	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0
	0.09233	0.25667	0.17493	0.19949	0.21177	0.03812	0	0	0	0	0	0	0	0	0	0	0.00805
	0.00805	0	0	0.01059	0	0	0	0	0								
2008	1	2	3	0	6	0	0	0	0	0	0	0	0	0	0	0	0.01504
	0.1411	0.3924	0.18704	0.09707	0.07219	0.04403	0	0	0	0	0	0	0	0	0	0.00848	0.04266
	0	0	0	0	0	0	0	0	0								

#

#Net fishery females

#year	season	type	gender	partition	# samples		16	18	20	22	24	26	28	30	32	34	36
	38	40	42	44	46	48	50	52	16	18	20	22	24	26	28	30	32
	34	36	38	40	42	44	46	48	50	52							
1983	1	3	3	0	24	0	0	0	0	0	0	0	0	0	0	0.01248	0.06211
	0.14868	0.19754	0.332	0.13685	0.02443	0	0.00307	0	0	0	0	0	0	0	0.01248	0.03545	0.02297
	0	0.01195	0	0	0	0	0	0	0								
1984	1	3	3	0	68	0	0.01047	0	0	0	0	0	0	0	0	0	0
	0.16667	0.29147	0.32045	0.10306	0.09742	0.01047	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0								
1985	1	3	3	0	155	0	0	0	0	0	0	0.00122	0	0.00021	0.00467	0.02343	0.07395
	0.09334	0.15591	0.24592	0.23791	0.06391	0.00509	0.00302	0	0	0	0	0	0	0.00015	0.00273	0.02204	0.03686
	0.01733	0.01211	0	0.0002	0	0	0	0	0								
1986	1	3	3	0	113	0	0	0	0	0	0	0.00023	0.0004	0.00057	0.00026	0.01582	0.06056
	0.18991	0.18421	0.21071	0.20903	0.05679	0.00621	0	0	0	0	0	0	0	0	0.00011	0.00566	0.02964
	0.00568	0.00403	0.00343	0.00667	0	0	0	0	0								
1987	1	3	3	0	92	0	0	0	0	0	0	0.00079	0.00162	0.00036	0.00232	0.00897	0.01165
	0.19355	0.2855	0.17057	0.1123	0.0467	0.01564	0.00089	0	0	0	0	0	0	0.00347	0.04653	0.01944	0.01772
	0.01386	0.04378	0.00194	0.00186	0	0	0	0	0								
1988	1	3	3	0	70	0	0	0	0	0	0.00041	0.00044	0.00117	0.0638	0.12296	0.00271	0.00163
	0.00385	0.31123	0.257	0.09212	0.01448	0.00127	0	0	0	0	0	0.00006	0.00015	0.00097	0.11848	0.00267	0.00138
	0.00279	0.00013	0.00005	0	0	0	0	0	0								
1989	1	3	3	0	82	0	0	0	0	0	0	0.01848	0.01832	0.03839	0.12987	0.14382	0.11016
	0.07334	0.12715	0.10056	0.13359	0.01859	0.01313	0.01893	0	0	0	0	0	0	0.0123	0.01375	0.01428	0.00822
	0.00655	0.00043	0.00014	0	0	0	0	0	0								
1990	1	3	3	0	99	0	0	0.00078	0	0	0.00057	0.0025	0.00785	0.01569	0.01327	0.0751	0.1624
	0.13408	0.04108	0.2186	0.08537	0.05356	0.00613	0.00021	0	0	0	0	0	0	0.00171	0.0388	0.04572	0.02568
	0.01163	0.04536	0.00371	0	0.0102	0	0	0	0								
1991	1	3	3	0	35	0	0	0	0	0	0.00144	0.00352	0.00863	0.0187	0.03612	0.08646	0.16717
	0.23046	0.13553	0.04859	0.03628	0.00927	0	0	0	0	0	0	0	0.00016	0.02781	0.06585	0.05945	0.04155
	0.00943	0.00767	0	0.00591	0	0	0	0	0								
# 1992 length comps had several large males from Morro Bay area - probably mis-ID'd sex or species- thus sample size turned to negative 1																	
-1992	1	3	3	0	1	0	0	0	0	0	0	0.00216	0.01539	0.00683	0.04506	0.07463	0.09314
	0.14088	0.16453	0.10951	0.10248	0.06281	0.00667	0	0	0	0	0	0	0.00139	0.01445	0.02481	0.08037	0.03203
	0.01596	0.00178	0.00095	0.00059	0.00027	0	0	0	0								

1993	1	3	3	0	35	0	0	0	0	0	0.00102	0.00848	0.01798	0.0186	0.03445	0.10195	0.15712
	0.24255	0.15447	0.09174	0.01546	0	0	0	0	0	0	0	0.00473	0.00358	0.04126	0.06158	0.02809	0.01171
	0.00428	0	0.00097	0	0	0	0	0	0								
1994	1	3	3	0	47	0	0	0	0	0	0	0	0	0.00085	0.01046	0.03534	0.05834
	0.11516	0.34256	0.15397	0.0921	0.05238	0.00712	0	0	0	0	0	0	0	0.00085	0.02841	0.03954	0.0351
	0.0278	0	0	0	0	0	0	0	0								
1995	1	3	3	0	32	0	0	0	0	0	0	0	0	0	0.00906	0	0.0436
	0.08736	0.31989	0.22707	0.20206	0.07282	0.02	0	0	0	0	0	0	0	0	0	0	0.01813
	0	0	0	0	0	0	0	0	0								
1996	1	3	3	0	21	0	0	0	0	0	0	0	0	0	0.01626	0.03252	0.0813
	0.1626	0.26016	0.25203	0.09756	0.07317	0	0	0	0	0	0	0	0	0	0	0.01626	0
	0	0	0	0	0.00813	0	0	0	0								
1997	1	3	3	0	14	0	0	0	0	0	0	0	0	0.01361	0.00537	0.00956	0.05249
	0.15283	0.29519	0.25541	0.11019	0.01381	0.01074	0	0	0	0	0	0	0	0	0.00517	0.01829	0.03229
	0.02504	0	0	0	0	0	0	0	0								
1998	1	3	3	0	11	0	0	0	0	0	0	0	0	0	0.01304	0.0087	0.01739
	0.14783	0.27391	0.33913	0.07826	0.02609	0	0	0	0	0	0	0	0	0	0.02174	0	0.04783
	0.01304	0	0.01304	0	0	0	0	0	0								

#

Recfin length comps Coastwide (N and S)

#year	season	type	gender	part	Nsamp	16	18	20	22	24	26	28	30	32	34	36	38
	40	42	44	46	48	50	52	16	18	20	22	24	26	28	30	32	34
	36	38	40	42	44	46	48	50	52								
1980	1	4	0	0	50	0.00255	0	0.01278	0.0358	0.07928	0.07672	0.13554	0.11253	0.11253	0.09718	0.07161	0.08439
	0.07161	0.04092	0.02813	0.02301	0.01278	0	0.00255	0.00255	0	0.01278	0.0358	0.07928	0.07672	0.13554	0.11253	0.11253	0.09718
	0.07161	0.08439	0.07161	0.04092	0.02813	0.02301	0.01278	0	0.00255								
1981	1	4	0	0	47	0.00127	0	0	0.00508	0.02033	0.0343	0.06607	0.14485	0.11689	0.13214	0.10673	0.1385
	0.08767	0.04447	0.04066	0.02668	0.02033	0.0127	0.00127	0.00127	0	0	0.00508	0.02033	0.0343	0.06607	0.14485	0.11689	0.13214
	0.10673	0.1385	0.08767	0.04447	0.04066	0.02668	0.02033	0.0127	0.00127								
1982	1	4	0	0	59	0	0	0	0	0.02427	0.05663	0.07605	0.08252	0.09061	0.06796	0.08576	0.12621
	0.13754	0.11488	0.05501	0.05016	0.02427	0.00647	0.00161	0	0	0	0	0.02427	0.05663	0.07605	0.08252	0.09061	0.06796
	0.08576	0.12621	0.13754	0.11488	0.05501	0.05016	0.02427	0.00647	0.00161								

1983	1	4	0	0	45	0	0	0.00464	0.01547	0.02321	0.07739	0.10371	0.15634	0.12848	0.07894	0.05417	0.0712	
	0.09287	0.07739	0.04489	0.04334	0.02321	0.00309	0.00154	0	0	0.00464	0.01547	0.02321	0.07739	0.10371	0.15634	0.12848	0.07894	
	0.05417	0.0712	0.09287	0.07739	0.04489	0.04334	0.02321	0.00309	0.00154									
1984	1	4	0	0	90	0	0	0.00254	0.00636	0.01908	0.03053	0.0547	0.0916	0.15267	0.20101	0.13613	0.07506	
	0.10432	0.07633	0.0318	0.01653	0.00127	0	0	0	0	0.00254	0.00636	0.01908	0.03053	0.0547	0.0916	0.15267	0.20101	
	0.13613	0.07506	0.10432	0.07633	0.0318	0.01653	0.00127	0	0									
1985	1	4	0	0	138	0.00099	0.00049	0.00198	0.00596	0.00994	0.01838	0.03628	0.09045	0.1332	0.12176	0.12524	0.14015	
	0.11282	0.08697	0.0656	0.02932	0.01391	0.00546	0.00099	0.00099	0.00049	0.00198	0.00596	0.00994	0.01838	0.03628	0.09045	0.1332	0.12176	
	0.12524	0.14015	0.11282	0.08697	0.0656	0.02932	0.01391	0.00546	0.00099									
1986	1	4	0	0	115	0	0.00095	0.00381	0.01858	0.07435	0.10724	0.05052	0.04718	0.07769	0.1101	0.0958	0.10247	
	0.13203	0.09103	0.04385	0.0305	0.01096	0.00238	0.00047	0	0.00095	0.00381	0.01858	0.07435	0.10724	0.05052	0.04718	0.07769	0.1101	
	0.0958	0.10247	0.13203	0.09103	0.04385	0.0305	0.01096	0.00238	0.00047									
1987	1	4	0	0	22	0	0	0.00761	0.01776	0.04568	0.08375	0.12436	0.11675	0.11675	0.10659	0.04568	0.05076	
	0.03299	0.06852	0.07614	0.04314	0.01776	0.0203	0.02538	0	0	0.00761	0.01776	0.04568	0.08375	0.12436	0.11675	0.11675	0.10659	
	0.04568	0.05076	0.03299	0.06852	0.07614	0.04314	0.01776	0.0203	0.02538									
1988	1	4	0	0	72	0	0	0	0.00323	0.02047	0.04956	0.12931	0.20474	0.23922	0.16056	0.02693	0.01724	
	0.02693	0.06142	0.03987	0.01185	0.00646	0	0.00215	0	0	0	0.00323	0.02047	0.04956	0.12931	0.20474	0.23922	0.16056	
	0.02693	0.01724	0.02693	0.06142	0.03987	0.01185	0.00646	0	0.00215									
1989	1	4	0	0	29	0	0	0	0.00219	0.0307	0.04495	0.0921	0.14692	0.1546	0.21052	0.21052	0.06469	
	0.02083	0.00986	0.00877	0.00328	0	0	0	0	0	0	0.00219	0.0307	0.04495	0.0921	0.14692	0.1546	0.21052	
	0.21052	0.06469	0.02083	0.00986	0.00877	0.00328	0	0	0									
1994	1	4	0	0	5	0	0	0	0	0.09677	0.06451	0.16129	0.16129	0.2258	0.16129	0.09677	0.03225	
	0	0	0	0	0	0	0	0	0	0	0	0.09677	0.06451	0.16129	0.16129	0.2258	0.16129	
	0.09677	0.03225	0	0	0	0	0	0	0									
1995	1	4	0	0	5	0	0	0	0.08053	0.05369	0.22147	0.26174	0.20134	0.12751	0.02684	0.02013	0	
	0	0	0	0	0	0	0.00671	0	0	0	0.08053	0.05369	0.22147	0.26174	0.20134	0.12751	0.02684	
	0.02013	0	0	0	0	0	0	0	0.00671									
1996	1	4	0	0	20	0	0	0.00359	0.05215	0.07553	0.14928	0.19064	0.09892	0.07553	0.10431	0.07913	0.05935	
	0.05575	0.04136	0.01258	0.00179	0	0	0	0	0	0.00359	0.05215	0.07553	0.14928	0.19064	0.09892	0.07553	0.10431	
	0.07913	0.05935	0.05575	0.04136	0.01258	0.00179	0	0	0									
1997	1	4	0	0	15	0	0	0	0.00338	0.0305	0.08305	0.05254	0.07627	0.05423	0.05423	0.07796	0.18474	
	0.17288	0.12542	0.05254	0.02203	0.00677	0.00338	0	0	0	0	0.00338	0.0305	0.08305	0.05254	0.07627	0.05423	0.05423	
	0.07796	0.18474	0.17288	0.12542	0.05254	0.02203	0.00677	0.00338	0									

1998	1	4	0	0	6	0	0	0	0	0.0114	0.01901	0.06083	0.19771	0.13307	0.12167	0.08365	0.06463
	0.11026	0.08745	0.07604	0.01901	0.0152	0	0	0	0	0	0	0.0114	0.01901	0.06083	0.19771	0.13307	0.12167
	0.08365	0.06463	0.11026	0.08745	0.07604	0.01901	0.0152	0	0								
1999	1	4	0	0	47	0	0.00516	0.01204	0.02065	0.02925	0.07056	0.07917	0.09294	0.06196	0.07228	0.06196	0.0981
	0.11187	0.16179	0.09122	0.02409	0.00516	0	0.00172	0	0.00516	0.01204	0.02065	0.02925	0.07056	0.07917	0.09294	0.06196	0.07228
	0.06196	0.0981	0.11187	0.16179	0.09122	0.02409	0.00516	0	0.00172								
2000	1	4	0	0	31	0	0.01086	0.08695	0.06521	0.02898	0.07246	0.07608	0.0942	0.06521	0.0471	0.02173	0.05797
	0.0942	0.09057	0.08695	0.08695	0.01086	0.00362	0	0	0.01086	0.08695	0.06521	0.02898	0.07246	0.07608	0.0942	0.06521	0.0471
	0.02173	0.05797	0.0942	0.09057	0.08695	0.08695	0.01086	0.00362	0								
2001	1	4	0	0	16	0	0	0.02675	0.09698	0.1806	0.0903	0.05685	0.05016	0.07692	0.05351	0.03678	0.05351
	0.08361	0.07023	0.07023	0.04013	0.01337	0	0	0	0	0.02675	0.09698	0.1806	0.0903	0.05685	0.05016	0.07692	0.05351
	0.03678	0.05351	0.08361	0.07023	0.07023	0.04013	0.01337	0	0								
2002	1	4	0	0	18	0	0	0	0.00888	0.13777	0.14666	0.14666	0.07111	0.01333	0.02666	0.04888	0.00888
	0.05333	0.07555	0.12	0.11111	0.02666	0.00444	0	0	0	0	0.00888	0.13777	0.14666	0.14666	0.07111	0.01333	0.02666
	0.04888	0.00888	0.05333	0.07555	0.12	0.11111	0.02666	0.00444	0								
#2004	1	4	0	0	41	0.00429	0.01716	0.01287	0.03433	0.11587	0.21459	0.13304	0.09442	0.1545	0.11158	0.07296	0.02575
	0.00429	0	0	0.00429	0	0	0	0.00429	0.01716	0.01287	0.03433	0.11587	0.21459	0.13304	0.09442	0.1545	0.11158
	0.07296	0.02575	0.00429	0	0	0.00429	0	0	0								
#2005	1	4	0	0	16	0	0.07547	0.30188	0.09433	0.01886	0.07547	0.0566	0.09433	0.03773	0.01886	0.13207	0.0566
	0.03773	0	0	0	0	0	0	0	0.07547	0.30188	0.09433	0.01886	0.07547	0.0566	0.09433	0.03773	0.01886
	0.13207	0.0566	0.03773	0	0	0	0	0	0								
#year	season	type	gender	part	Nsamp	16	18	20	22	24	26	28	30	32	34	36	38
	40	42	44	46	48	50	52	16	18	20	22	24	26	28	30	32	34
	36	38	40	42	44	46	48	50	52								
2004	1	4	0	0	16	0.01	0.0134	0.01	0.0302	0.104	0.208	0.1308	0.1006	0.1577	0.1342	0.0671	0.0268
	0.0033	0	0	0.0033	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0								
2005	1	4	0	0	18	0.0036	0.0254	0.0727	0.1127	0.2109	0.1236	0.0436	0.0472	0.0327	0.0509	0.1018	0.1309
	0.04	0.0036	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0								
2006	1	4	0	0	19	0.0031	0.0062	0.0248	0.1024	0.177	0.2142	0.1987	0.0745	0.0341	0.0465	0.0341	0.0527
	0.0186	0.0093	0.0031	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0								

2007	1	4	0	0	18	0.0041	0.002	0.0248	0.0788	0.0975	0.0394	0.0373	0.0705	0.0892	0.0477	0.0311	0.0435
	0.1493	0.1908	0.0643	0.0145	0.0082	0.0062	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0								
2008	1	4	0	0	18	0.0066	0.0167	0.0367	0.1304	0.1337	0.224	0.0969	0.0735	0.0602	0.0568	0.0468	0.0133
	0.0267	0.0434	0.0234	0.0033	0.0033	0.0033	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0								
2009	1	4	0	0	17	0.0133	0.0266	0.0622	0.1688	0.2533	0.0711	0.1288	0.1022	0.0622	0.0133	0.0311	0.0088
	0.0177	0.0088	0.0133	0.0133	0.0044	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0								
2010	1	4	0	0	17	0.009	0.0543	0.1601	0.2084	0.1752	0.1299	0.0966	0.0694	0.0332	0.0302	0.006	0.003
	0.003	0.003	0.003	0.009	0.003	0.003	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0								
2011	1	4	0	0	19	0.0112	0.0544	0.1616	0.1552	0.1392	0.0976	0.1072	0.056	0.048	0.0496	0.016	0.0256
	0.0144	0.0272	0.0208	0.0096	0.0064	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0								
2012	1	4	0	0	25	0.0056	0.0127	0.1943	0.2666	0.1659	0.1262	0.0865	0.0765	0.0255	0.0113	0.0113	0.0028
	0.0028	0.0014	0.007	0	0.0028	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0								
2013	1	4	0	0	19	0.023	0.0853	0.149	0.1273	0.1707	0.1504	0.13	0.0718	0.0487	0.0121	0.0094	0.0067
	0.004	0	0.0054	0.0013	0.0013	0.0013	0.0013	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0								
2014	1	4	0	0	16	0.0466	0.0601	0.1022	0.224	0.2526	0.1007	0.0661	0.0661	0.0436	0.0225	0.0075	0.0015
	0.0015	0.003	0.0015	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0								

#

Triennial survey length data-

1977	1	5	3	0	56	0.00132	0.0028	0.01864	0.04554	0.02555	0.01866	0.01316	0.01863	0.04304	0.08371	0.05878	0.02463
	0.03757	0.05619	0.05998	0.05109	0.04681	0.02098	0.00456	0.00157	0.0026	0.01833	0.04147	0.01525	0.01458	0.01431	0.06889	0.08181	0.06158
	0.03506	0.00853	0.00065	0.00107	0.00148	0.00043	0.00057	0	0								
1980	1	5	3	0	17	0	0	0	0	0	0.00102	0.00022	0.00442	0.03417	0.0489	0.06656	0.04987
	0.08431	0.09185	0.06391	0.0378	0.0108	0.01103	0.00138	0	0	0.00092	0.00123	0.00056	0.00021	0.01013	0.06132	0.15277	0.18459
	0.06082	0.00831	0.00208	0.00842	0.00156	0.00056	0.00014	0	0								

1983	1	5	3	0	17	0.00147	0.00236	0.00222	0.00237	0.01546	0.03155	0.05519	0.09165	0.11927	0.04888	0.01741	0.01022
	0.02294	0.02131	0.01335	0.01473	0.01341	0.00281	0.00054	0.00129	0.00236	0.00082	0.00187	0.01964	0.04507	0.13632	0.1805	0.0633	0.03084
	0.02869	0.00197	0	0	0.00003	0	0	0	0								
1986	1	5	3	0	14	0.00021	0.00021	0.054	0.09675	0.10531	0.03826	0.00166	0.00191	0.00319	0.01658	0.03826	0.06103
	0.04773	0.04995	0.01422	0.00968	0.00458	0.00138	0	0	0.00214	0.042	0.0741	0.12401	0.01268	0.01143	0.06192	0.07889	0.03768
	0.0074	0.00226	0.00044	0	0	0	0	0	0								
1989	1	5	3	0	91	0.14115	0.08542	0.00522	0.01077	0.0188	0.01236	0.02578	0.03328	0.01295	0.01263	0.03708	0.04408
	0.00765	0.01092	0.01361	0.00611	0.00323	0.00099	0.00065	0.15814	0.07824	0.00423	0.01606	0.01862	0.03192	0.05855	0.05072	0.05481	0.02932
	0.01254	0.00347	0.00022	0.00004	0.00005	0	0	0.00009	0.00009								
1992	1	5	3	0	59	0.24397	0.02135	0.01956	0.025	0.00991	0.0186	0.04261	0.03886	0.01397	0.00795	0.00448	0.00373
	0.00244	0.00253	0.00212	0.00026	0.00065	0.00006	0	0.2715	0.01878	0.02134	0.02997	0.01546	0.0718	0.06547	0.0214	0.01717	0.00594
	0.00245	0.00024	0.00006	0	0	0	0.00012	0.00006	0								
1995	1	5	3	0	79	0.07182	0.0105	0.02365	0.03701	0.03052	0.00774	0.01664	0.03555	0.02933	0.02137	0.02177	0.04439
	0.03114	0.02686	0.02366	0.01874	0.00794	0.00212	0.00033	0.08029	0.0065	0.02289	0.03343	0.02708	0.04323	0.06932	0.08634	0.09242	0.05937
	0.01576	0.00175	0.00006	0.00016	0.00008	0.00008	0	0	0								
1998	1	5	3	0	81	0.01317	0.03329	0.02219	0.01371	0.05545	0.10907	0.02906	0.01489	0.0305	0.05614	0.00735	0.00612
	0.01038	0.01613	0.00776	0.00386	0.00265	0.00042	0	0.00908	0.02868	0.02244	0.03439	0.12487	0.07326	0.08847	0.09834	0.06031	0.02068
	0.00673	0.00042	0	0	0	0.00003	0	0	0								
2001	1	5	3	0	77	0.00367	0.01002	0.05792	0.2417	0.11619	0.00883	0.00665	0.00424	0.00695	0.00655	0.00921	0.00452
	0.00343	0.00301	0.00261	0.00244	0.00065	0.00001	0	0.00531	0.00575	0.09168	0.27631	0.08195	0.00664	0.01412	0.018	0.00695	0.00373
	0.00063	0.00013	0	0.00001	0	0	0	0	0								
2004	1	5	3	0	88	0.11449	0.00173	0.00278	0.00155	0.00074	0.0159	0.01839	0.00552	0.01475	0.07254	0.14576	0.06047
	0.01188	0.00359	0.00538	0.00669	0.00589	0.00154	0.00022	0.1552	0.00081	0.0029	0.0018	0.00745	0.01609	0.05755	0.12913	0.1032	0.02382
	0.01048	0.00153	0.00004	0	0	0.00004	0	0	0								

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NWC combo survey

#year	season	type	gender	part	#_samp	16	18	20	22	24	26	28	30	32	34	36	38
	40	42	44	46	48	50	52	16	18	20	22	24	26	28	30	32	34
	36	38	40	42	44	46	48	50	52								
2003	1	6	3	0	86	0.00791	0.00989	0.00795	0.00224	0.0081	0.00512	0.01166	0.03314	0.12573	0.19161	0.03388	0.00762
	0.00262	0.00155	0.00085	0.00315	0.00076	0.00165	0	0.01267	0.01439	0.00438	0.00656	0.006	0.01057	0.10126	0.1985	0.10436	0.06571
	0.01977	0.00001	0.0002	0	0	0.00002	0	0	0								
2004	1	6	3	0	80	0.04404	0.01369	0.00472	0.03525	0.02799	0.01465	0.01927	0.01316	0.03029	0.0799	0.14514	0.08653
	0.02008	0.00372	0.00344	0.00324	0.00297	0.00211	0.00011	0.04495	0.01289	0.00742	0.01816	0.01508	0.01046	0.02821	0.143	0.13338	0.02808
	0.00745	0.00044	0	0	0	0.00004	0	0	0								

2005	1	6	3	0	87	0.02407	0.0093	0.01775	0.01466	0.00372	0.00516	0.00377	0.02036	0.01414	0.04223	0.21656	0.14043
	0.03212	0.01323	0.00496	0.00421	0.00225	0.00086	0.00032	0.02749	0.01076	0.01335	0.01627	0.00679	0.00303	0.10675	0.15658	0.06235	0.02254
	0.00276	0.00032	0.00075	0	0	0	0	0	0								
2006	1	6	3	0	70	0.00203	0.00398	0.00552	0.02027	0.01898	0.0162	0.01346	0.00799	0.01636	0.01809	0.01738	0.05072
	0.1083	0.09014	0.02235	0.02541	0.00979	0.00467	0.00087	0.00083	0.00259	0.00524	0.02529	0.02382	0.02134	0.01556	0.04352	0.16058	0.21343
	0.03339	0.00055	0	0.00118	0	0	0	0	0								
2007	1	6	3	0	68	0.00694	0.00498	0.00225	0.00466	0.00199	0.0082	0.02121	0.07737	0.04765	0.03895	0.04959	0.04502
	0.08783	0.1312	0.06906	0.01145	0.00483	0.00062	0	0.00748	0.00531	0.00229	0.00354	0.00286	0.02366	0.03255	0.06361	0.13585	0.08918
	0.01884	0.00072	0.00015	0	0	0	0	0	0								
2008	1	6	3	0	80	0.0525	0.00721	0.00604	0.00028	0.00324	0.00703	0.01813	0.02166	0.01324	0.01451	0.01361	0.02326
	0.04604	0.15283	0.08107	0.03308	0.01564	0.00388	0.00182	0.03163	0.00915	0.00343	0.00295	0.0132	0.03037	0.04733	0.0635	0.11672	0.11197
	0.03643	0.00494	0.00112	0.00584	0.00462	0.00139	0.00018	0	0								
2009	1	6	3	0	81	0.0658	0.00339	0.00526	0.0125	0.01259	0.00621	0.00363	0.00586	0.01648	0.02718	0.04003	0.02169
	0.02812	0.05753	0.0778	0.02552	0.00907	0.00291	0.00019	0.05909	0.0041	0.01079	0.01667	0.00584	0.00231	0.02267	0.11744	0.16747	0.14053
	0.02207	0.00893	0.00018	0	0	0	0	0	0								
2010	1	6	3	0	106	0.29939	0.0549	0.008	0.00317	0.0129	0.00933	0.00413	0.00381	0.00368	0.0041	0.00407	0.00723
	0.01253	0.01723	0.02504	0.01062	0.00814	0.00846	0.00175	0.35807	0.04169	0.00091	0.00705	0.00986	0.00345	0.00562	0.01133	0.02472	0.0291
	0.00925	0.00017	0	0	0	0.00015	0	0	0								
2011	1	6	3	0	84	0.08495	0.04076	0.01536	0.16185	0.10881	0.01095	0.02466	0.00714	0.0035	0.01056	0.01115	0.01739
	0.02143	0.01288	0.01679	0.01724	0.00626	0	0	0.0458	0.03999	0.01361	0.15985	0.05987	0.00563	0.01428	0.02029	0.02578	0.02624
	0.01411	0.00274	0	0	0	0	0	0	0								
2012	1	6	3	0	105	0.07067	0.0216	0.04496	0.19184	0.0522	0.00761	0.06991	0.00539	0.01781	0.00115	0.00058	0.01
	0.00658	0.01156	0.01748	0.01149	0.00253	0.00013	0	0.07963	0.01119	0.08674	0.08155	0.05255	0.03383	0.06017	0.00346	0.01439	0.02289
	0.00806	0.0006	0	0.00063	0	0.00067	0	0	0								
2013	1	6	3	0	96	0.21987	0.00358	0.00506	0.00457	0.01956	0.07651	0.05492	0.05832	0.03449	0.0168	0.00028	0.00072
	0.00437	0.01203	0.01371	0.01437	0.00482	0.00142	0	0.21259	0.0046	0.00303	0.00252	0.05165	0.07954	0.04636	0.01941	0.00989	0.01868
	0.0053	0.00054	0	0.00031	0	0	0	0	0								
2014	1	6	3	0	127	0.0522	0.02886	0.0063	0.00563	0.01611	0.00677	0.00808	0.04705	0.08093	0.07156	0.05188	0.02092
	0.00143	0.01479	0.05969	0.0452	0.01682	0.01489	0	0.07331	0.02127	0.00601	0.01423	0.01824	0.02237	0.08382	0.04607	0.01124	0.02091
	0.02169	0.01445	0.00075	0	0.04132	0.04127	0.01375	0	0								

#

#Recreational Length data - June 15 fix to TL-> FL conversion!!

#year	season	type	gender	part	numsamp		16	18	20	22	24	26	28	30	32	34	36
	38	40	42	44	46	48	50	52	16	18	20	22	24	26	28	30	32
	34	36	38	40	42	44	46	48	50	52							
1987	1	10	0	0	43	0.0007	0	0.00141	0.01131	0.03182	0.13932	0.30622	0.31046	0.13649	0.01909	0.01202	0.01202
	0.01131	0.00353	0.00353	0.0007	0	0	0	0.0007	0	0.00141	0.01131	0.03182	0.13932	0.30622	0.31046	0.13649	0.01909
	0.01202	0.01202	0.01131	0.00353	0.00353	0.0007	0	0	0								
1988	1	10	0	0	44	0.0011	0.00221	0.00832	0.03329	0.07103	0.07047	0.12042	0.22031	0.24028	0.15149	0.04495	0.00832
	0.00998	0.00887	0.00277	0.00166	0.00332	0.0011	0	0.0011	0.00221	0.00832	0.03329	0.07103	0.07047	0.12042	0.22031	0.24028	0.15149
	0.04495	0.00832	0.00998	0.00887	0.00277	0.00166	0.00332	0.0011	0								
1989	1	10	0	0	58	0	0.00122	0.00183	0.01102	0.02205	0.03063	0.09803	0.19852	0.17401	0.1734	0.17095	0.06617
	0.02205	0.0147	0.00857	0.00428	0.00183	0	0.00061	0	0.00122	0.00183	0.01102	0.02205	0.03063	0.09803	0.19852	0.17401	0.1734
	0.17095	0.06617	0.02205	0.0147	0.00857	0.00428	0.00183	0	0.00061								
1990	1	10	0	0	16	0	0	0	0	0.00716	0.04659	0.09318	0.15412	0.17204	0.07526	0.10394	0.17921
	0.09318	0.04659	0.02508	0.00358	0	0	0	0	0	0	0	0.00716	0.04659	0.09318	0.15412	0.17204	0.07526
	0.10394	0.17921	0.09318	0.04659	0.02508	0.00358	0	0	0								
1991	1	10	0	0	15	0	0	0.00256	0.01794	0.04615	0.12564	0.11794	0.14871	0.07948	0.05128	0.04871	0.12051
	0.10769	0.06923	0.04358	0.01794	0.00256	0	0	0	0	0.00256	0.01794	0.04615	0.12564	0.11794	0.14871	0.07948	0.05128
	0.04871	0.12051	0.10769	0.06923	0.04358	0.01794	0.00256	0	0								
1992	1	10	0	0	32	0	0	0.00941	0.04143	0.05775	0.15379	0.20966	0.17137	0.09165	0.05963	0.03766	0.04331
	0.04959	0.05524	0.00941	0.0069	0.00251	0.00062	0	0	0	0.00941	0.04143	0.05775	0.15379	0.20966	0.17137	0.09165	0.05963
	0.03766	0.04331	0.04959	0.05524	0.00941	0.0069	0.00251	0.00062	0								
1993	1	10	0	0	37	0	0.00061	0.00553	0.02642	0.0381	0.08358	0.09649	0.13952	0.16041	0.11124	0.07682	0.05777
	0.06883	0.06084	0.03749	0.02274	0.01167	0.00184	0	0	0.00061	0.00553	0.02642	0.0381	0.08358	0.09649	0.13952	0.16041	0.11124
	0.07682	0.05777	0.06883	0.06084	0.03749	0.02274	0.01167	0.00184	0								
1994	1	10	0	0	26	0.0008	0.00161	0.00726	0.03069	0.10904	0.1155	0.1357	0.1042	0.10339	0.10985	0.11227	0.07108
	0.0315	0.02827	0.02019	0.01615	0.00242	0	0	0.0008	0.00161	0.00726	0.03069	0.10904	0.1155	0.1357	0.1042	0.10339	0.10985
	0.11227	0.07108	0.0315	0.02827	0.02019	0.01615	0.00242	0	0								
1995	1	10	0	0	22	0	0.00892	0.05535	0.03928	0.06428	0.07142	0.10535	0.10892	0.18214	0.10892	0.08571	0.06785
	0.05357	0.02321	0.01607	0.00714	0.00178	0	0	0	0.00892	0.05535	0.03928	0.06428	0.07142	0.10535	0.10892	0.18214	0.10892
	0.08571	0.06785	0.05357	0.02321	0.01607	0.00714	0.00178	0	0								
1996	1	10	0	0	19	0	0	0.01167	0.02918	0.0642	0.11867	0.13035	0.0642	0.09533	0.13424	0.09338	0.10894
	0.07782	0.05058	0.01945	0.00194	0	0	0	0	0	0.01167	0.02918	0.0642	0.11867	0.13035	0.0642	0.09533	0.13424
	0.09338	0.10894	0.07782	0.05058	0.01945	0.00194	0	0	0								

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1997	1	10	0	0	19	0	0	0	0.00523	0.04712	0.12565	0.08115	0.09162	0.04973	0.0445	0.06806	0.1335
	0.17015	0.10471	0.04712	0.01832	0.01047	0.00261	0	0	0	0	0.00523	0.04712	0.12565	0.08115	0.09162	0.04973	0.0445
	0.06806	0.1335	0.17015	0.10471	0.04712	0.01832	0.01047	0.00261	0
1998	1	10	0	0	9	0	0	0	0	0.00955	0.01592	0.0605	0.18471	0.13057	0.10828	0.08917	0.09554
	0.12101	0.08598	0.07006	0.01592	0.01273	0	0	0	0	0	0	0.00955	0.01592	0.0605	0.18471	0.13057	0.10828
	0.08917	0.09554	0.12101	0.08598	0.07006	0.01592	0.01273	0	0
#


# Age composition data
21	# number of age bins
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	19	20	21

1	# number of unique ageing error matrices to generate
# ageing error matrix- no bias, has imprecision (st dev)
#0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5
	18.5	19.5	20.5	21.5
#0.03	0.091	0.153	0.214	0.275	0.336	0.398	0.459	0.52	0.581	0.643	0.704	0.765	0.826	0.888	0.949	1.01	1.072
	1.133	1.194	1.255	1.317
0.4768	1.4304	2.384	3.3376	4.2912	5.2447	6.1983	7.1519	8.1055	9.0591	10.0127	10.9663	11.9199	12.8735	13.8271	14.7806	15.8	16.8
	17.8	18.8	19.8	20.8
0.107	0.107	0.2141	0.3211	0.4282	0.5352	0.6423	0.7493	0.8564	0.9634	1.0705	1.1775	1.2845	1.3916	1.4986	1.6057	1.61	1.61
	1.61	1.61	1.61	1.61


84	#_number of age observations
2	#_Lbin_method: 1=poplenbins; 2=datalenbins; 3=lengths
0	#_combine males into females at or below this bin number

# this run goes back to traditional age comps-
#year	season	type	gender	part	errmat	Lbinlo	LbinHi	# samp	1	2	3	4	5	6	7	8	9
	10	11	12	13	14	15	16	17	18	19	20	plus	1	2	3	4	5
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	plus
```

-1978	1	1	3	0	1	1	52	1	0	0	0.00378	0.00192	0.05193	0.06229	0.08103	0.11205	0.0285
	0.02318	0.1395	0.04135	0.00805	0.00451	0.01162	0.01389	0.03325	0.01976	0.03987	0.0299	0.0635	0	0	0.00086	0.00094	0.01108
	0.03327	0.03173	0.02462	0.00872	0.00288	0.01137	0.02357	0.02161	0.04333	0.00117	0.00127	0.00263	0.00019	0.00142	0.0035	0.00597	
-1979	1	1	3	0	1	1	52	1	0	0	0.02289	0.04417	0.03256	0.12065	0.06067	0.05047	0.1531
	0.09065	0.03673	0.0262	0.01061	0.00285	0.02734	0.01818	0.01339	0.00627	0.02685	0.00403	0.00893	0	0	0.01917	0.05047	0.03043
	0.00964	0.00342	0.0042	0.02474	0.00362	0	0.00462	0.00335	0.01917	0.00044	0.00141	0.05746	0.00223	0.00531	0.00335	0.00044	
1980	1	1	3	0	1	1	52	120	0	0	0.00079	0.01116	0.07118	0.03558	0.24243	0.01848	0.04077
	0.07396	0.01513	0.0116	0.04232	0.01038	0.00231	0.05865	0.00011	0.00244	0.0029	0.00044	0.01973	0	0.00102	0.00435	0.007	0.05788
	0.07713	0.04955	0.00622	0.00431	0.03101	0.00437	0.05813	0.00071	0.00266	0.00096	0.00918	0.00028	0.00333	0.00621	0.00103	0.01431	
1981	1	1	3	0	1	1	52	80	0	0	0.00121	0.00551	0.15777	0.20849	0.03943	0.15607	0.01213
	0.00378	0.00498	0.00835	0.0039	0.05709	0.00182	0.00056	0.00245	0.00194	0.00101	0.00021	0.00806	0	0	0.04975	0.00037	0.05482
	0.02426	0.00489	0.12049	0.00215	0.00208	0.00777	0.00153	0.00261	0.05139	0.0007	0.00008	0.00007	0.00024	0	0.00015	0.00187	
1982	1	1	3	0	1	1	52	135	0	0.00006	0.00795	0.02247	0.05293	0.03563	0.21462	0.053	0.17273
	0.01588	0.04724	0.04183	0.0206	0.01731	0.01459	0.00567	0.00705	0.002	0.01187	0.00069	0.01252	0	0	0.00646	0.00462	0.01703
	0.01767	0.07607	0.01949	0.04761	0.00885	0.01292	0.01438	0.00282	0.00729	0.00479	0.00001	0.00012	0	0	0.00026	0.00296	
1983	1	1	3	0	1	1	52	254	0	0	0.00712	0.04191	0.02014	0.03882	0.07728	0.22797	0.09597
	0.08751	0.04105	0.05616	0.0338	0.02631	0.00968	0.01863	0.00111	0.00751	0.00826	0.01526	0.02535	0	0.00006	0.00528	0.02822	0.01055
	0.00792	0.02584	0.03455	0.00701	0.01561	0.00306	0.00564	0.00299	0.00495	0.00147	0.00218	0.00057	0.00277	0	0.00071	0.00073	
1984	1	1	3	0	1	1	52	202	0	0.00002	0.03783	0.10336	0.17369	0.086	0.05089	0.04349	0.09149
	0.02664	0.02702	0.01316	0.02271	0.01373	0.02425	0.00804	0.00912	0.00185	0.00051	0.00106	0.00579	0	0.00335	0.01033	0.04641	0.03068
	0.01707	0.013	0.01551	0.03336	0.02777	0.01319	0.01903	0.00578	0.00412	0.00282	0.01028	0.00259	0.00077	0.00085	0.00012	0.00234	
1985	1	1	3	0	1	1	52	303	0	0.00002	0.00279	0.02507	0.06476	0.16204	0.08104	0.0408	0.03527
	0.0363	0.04287	0.02739	0.02872	0.0188	0.01871	0.00889	0.00452	0.00542	0.00493	0.00236	0.00932	0	0.00006	0.00011	0.01536	0.01544
	0.04936	0.04948	0.03218	0.02924	0.04719	0.03604	0.0216	0.01902	0.02613	0.00676	0.00622	0.00532	0.00345	0.00422	0.00134	0.01145	
1986	1	1	3	0	1	1	52	111	0	0.00466	0.0088	0.02095	0.07726	0.1109	0.08903	0.04127	0.03736
	0.03883	0.06767	0.02447	0.03381	0.01699	0.02167	0.009	0.00728	0.00213	0.0115	0.00149	0.00566	0	0.00432	0.00224	0.00663	0.02418
	0.05423	0.05353	0.03077	0.04701	0.02541	0.04662	0.01493	0.02899	0.00422	0.01179	0.00263	0.00212	0.00145	0.00082	0.00062	0.00677	
1987	1	1	3	0	1	1	52	205	0.04462	0.03154	0.32482	0.01466	0.01095	0.03123	0.04142	0.06563	0.01636
	0.00299	0.00499	0.01538	0.00375	0.00637	0.0031	0.0003	0.00124	0.0015	0.00091	0.00021	0.00033	0.01785	0.00009	0.14746	0.01224	0.01089
	0.00733	0.03271	0.05213	0.01475	0.01071	0.01644	0.0176	0.0049	0.01238	0.00473	0.00156	0.00458	0.00502	0.00004	0.00111	0.00318	
1988	1	1	3	0	1	1	52	190	0	0.00014	0.02819	0.4067	0.00423	0.00113	0.05054	0.01579	0.04125
	0.00992	0.01415	0.00033	0.01861	0.00391	0.00258	0.00003	0.006	0.00209	0.00002	0.00026	0.00374	0	0.00029	0.00118	0.25377	0.00371
	0.00355	0.0084	0.01968	0.04651	0.01432	0.00167	0.00778	0.00472	0.00051	0.00218	0.01048	0.00127	0.00903	0.00018	0.00018	0.00099	

1989	1	1	3	0	1	1	52	174	0	0.00011	0.03457	0.03029	0.42988	0.00165	0.00067	0.00855	0.00895
	0.01759	0.00249	0.00141	0.00068	0.00803	0.0001	0.00207	0	0.00005	0.00022	0.00004	0.00045	0	0.00009	0.0226	0.03778	0.26056
	0.00339	0.0004	0.02036	0.01849	0.03719	0.00432	0.00165	0.00124	0.01195	0.0142	0.00599	0.00869	0.00042	0.0009	0.00006	0.00193	
1990	1	1	3	0	1	1	52	133	0	0.02742	0.05254	0.03834	0.05285	0.21303	0.15181	0.00314	0.03976
	0.00441	0.00642	0.00111	0.00497	0.00056	0.00317	0.00028	0.00123	0.00031	0.0009	0.00119	0.00411	0.00003	0.01388	0.03816	0.0536	0.02873
	0.10087	0.04477	0.00425	0.01313	0.01413	0.0257	0.00296	0.01804	0.00942	0.0079	0.00345	0.00728	0.00259	0.0012	0.00036	0.00199	
1991	1	1	3	0	1	1	52	66	0	0.03237	0.08143	0.08939	0.06549	0.04964	0.15004	0.03589	0.00976
	0.01119	0.01278	0.00956	0.00144	0.0128	0	0.00836	0	0.00124	0	0	0.03012	0	0.01674	0.10708	0.05087	0.03811
	0.01699	0.07145	0.02294	0.00555	0.0088	0.01073	0.01334	0.00211	0.00911	0.00072	0.00827	0.0001	0.00199	0.00012	0	0.01349	
1992	1	1	3	0	1	1	52	100	0	0.00306	0.088	0.12952	0.10098	0.10262	0.05166	0.09095	0.03579
	0.00788	0.01178	0.00858	0.0194	0.01313	0.01225	0.00157	0.00301	0.00157	0.00611	0.00128	0.00551	0	0.0016	0.02928	0.03758	0.03687
	0.04847	0.02022	0.06001	0.02501	0.0074	0.0019	0.00156	0.01092	0.00271	0.0066	0.00209	0.00136	0.00054	0.00501	0.00004	0.00615	
1993	1	1	3	0	1	1	52	75	0.00025	0.00174	0.02104	0.1297	0.118	0.09357	0.05244	0.0481	0.07239
	0.01097	0.00529	0.01416	0.0095	0.01103	0.00428	0.0025	0.00186	0.00289	0.00071	0.00513	0.00153	0	0.00166	0.02201	0.10917	0.05945
	0.05701	0.02266	0.01381	0.04	0.01438	0.00794	0.00644	0.00507	0.00306	0.00583	0.01028	0.00096	0.00355	0.00057	0.00192	0.00717	
1994	1	1	3	0	1	1	52	76	0	0.00248	0.07104	0.0454	0.13842	0.08056	0.09087	0.04623	0.01417
	0.06873	0.02104	0.00153	0.00473	0.0061	0.00337	0.00383	0.00147	0.00061	0.00588	0.00062	0.00098	0	0.0046	0.04132	0.04996	0.04147
	0.04859	0.04356	0.02342	0.03959	0.03571	0.01772	0.00435	0.01236	0.00557	0.0056	0.0057	0.0051	0.00122	0.00013	0.00105	0.00494	
1995	1	1	3	0	1	1	52	57	0	0.00404	0.02541	0.0728	0.08673	0.12557	0.08214	0.06132	0.04067
	0.01859	0.04225	0.01223	0.00378	0.00687	0.00515	0.00146	0.00288	0.00047	0	0.00172	0.00367	0	0.00544	0.01632	0.03919	0.03082
	0.05457	0.03673	0.03411	0.03743	0.01884	0.03969	0.02024	0.01218	0.00496	0.00986	0.01253	0.00477	0.00522	0.00009	0.00915	0.01012	
1996	1	1	3	0	1	1	52	64	0	0.00763	0.1728	0.01501	0.07585	0.07577	0.02908	0.0377	0.04358
	0.01553	0.00983	0.03194	0.00415	0	0.00155	0.00496	0.00284	0.00158	0	0.00624	0.00107	0	0.02565	0.11716	0.03339	0.034
	0.04137	0.05519	0.02609	0.02877	0.01265	0.02855	0.01731	0.01346	0.00214	0.00171	0.00015	0.00179	0.00063	0.01215	0.00359	0.00716	
1997	1	1	3	0	1	1	52	71	0	0.00132	0.01069	0.18465	0.07381	0.06563	0.06212	0.05927	0.04544
	0.03139	0.01655	0.01236	0.01119	0.00124	0.00447	0.00364	0.00324	0.00406	0.00196	0	0.00173	0	0	0.0152	0.14505	0.05635
	0.04362	0.03408	0.02759	0.01579	0.01125	0.01111	0.0176	0.00923	0.00209	0.00123	0.00056	0.0022	0.00571	0.00007	0.00099	0.00552	
-1998	1	1	3	0	1	1	52	1	0	0.00185	0.01358	0.01991	0.11579	0.06233	0.08108	0.07869	0.07642
	0.05378	0.04527	0.02623	0.01928	0.01991	0.00429	0.00127	0.00187	0.0018	0.0023	0.00021	0.00795	0.00031	0.00093	0.01815	0.01496	0.06433
	0.01016	0.04198	0.04395	0.03572	0.03541	0.01461	0.01351	0.03056	0.00985	0.01385	0.00231	0.00231	0.00326	0.00503	0.00238	0.00265	
-1999	1	1	3	0	1	1	52	1	0	0.00006	0.00173	0.10925	0.06315	0.13796	0.04408	0.0662	0.04837
	0.05063	0.04667	0.01942	0.01212	0.00903	0.0089	0.00263	0.00008	0.00094	0.00205	0.0029	0.00533	0	0.00332	0.00007	0.05304	0.03379
	0.10262	0.02641	0.04117	0.02579	0.02087	0.01269	0.00879	0.00482	0.0069	0.00728	0.00496	0.00373	0.00287	0.00227	0.0001	0.00702	

-2000	1	1	3	0	1	1	52	1	0	0.00002	0.00014	0.01344	0.06178	0.06835	0.11776	0.06001	0.07294
	0.03955	0.07104	0.05061	0.04365	0.02505	0.0218	0.01716	0.00218	0.00061	0.00321	0.00504	0.00363	0	0.00003	0.0051	0.00683	0.04577
	0.02892	0.05689	0.01984	0.03343	0.00977	0.0231	0.01241	0.03636	0.00292	0.00904	0.00465	0.00715	0.00008	0.00178	0.00268	0.01525	
2001	1	1	3	0	1	1	52	23	0.0009	0.01761	0.0093	0.02139	0.03552	0.13228	0.07052	0.13274	0.05431
	0.04817	0.02637	0.02695	0.028	0.02513	0.00513	0.00408	0	0.00405	0.00102	0	0.00518	0.0018	0.02358	0.00336	0.01142	0.01598
	0.03543	0.04657	0.06113	0.01708	0.02996	0.0256	0.01227	0.01829	0.01634	0.00428	0.00515	0.01275	0.0018	0	0.00071	0.00784	
2002	1	1	3	0	1	1	52	31	0.00126	0.00519	0.14825	0.07593	0.03391	0.03431	0.07351	0.04639	0.09528
	0.02917	0.04017	0.02066	0.05252	0.0251	0.02963	0.00392	0.01029	0.01613	0.00166	0.00083	0.00317	0.0003	0.00388	0.07294	0.03825	0.00824
	0.01287	0.02868	0.01071	0.03351	0.00561	0.01174	0.00248	0.00351	0.00683	0.00442	0.00052	0.00317	0.00247	0	0.00006	0.00257	
2003	1	1	3	0	1	1	52	9	0	0.00016	0.01887	0.61473	0.01414	0.00693	0.00484	0.00961	0.00441
	0.0041	0.00512	0.00221	0.00276	0.00221	0.00102	0.00307	0.00102	0.00118	0.00102	0	0	0	0.00063	0.01768	0.23438	0.0206
	0.00197	0.00228	0.00221	0.00607	0.00087	0.0026	0.00173	0.00347	0.00347	0.00189	0.00087	0	0.00087	0.00102	0	0	
2004	1	1	3	0	1	1	52	33	0	0.00099	0.00483	0.02117	0.32677	0.07346	0.02548	0.03422	0.05385
	0.02661	0.03364	0.01354	0.01335	0.00763	0.01656	0.01126	0.00744	0.00654	0.0117	0.00401	0.00143	0	0	0.00313	0.01417	0.20207
	0.02458	0.0176	0.00118	0.00983	0.01118	0.00368	0.00148	0.00346	0	0.00203	0.00074	0.00074	0.00434	0.00203	0	0.00327	
2005	1	1	3	0	1	1	52	15	0	0.00082	0	0.05207	0.11353	0.4349	0.04918	0.01954	0.02939
	0.01235	0.00348	0.00256	0.0001	0.00985	0.0098	0.00251	0.00256	0.00005	0.00251	0	0	0	0	0	0.03266	0.0368
	0.14335	0.02588	0.00343	0.00251	0.00343	0	0	0	0.00082	0.00251	0	0	0	0	0	0.00343	
# new data for 2015 update																	
#year	season	type	gender	part	errmat	Lbinlo	LbinHi	#samples		1	2	3	4	5	6	7	8
	9	10	11	12	13	14	15	16	17	18	19	20	plus	1	2	3	4
	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	plus
2007	1	1	3	0	1	1	52	21	0	0	0	0.00791	0.01186	0.02174	0.02767	0.3004	0.22134
	0.06522	0.00791	0.02372	0.01976	0.01779	0.00988	0.00593	0.00593	0.00395	0.00198	0.00395	0.00593	0	0	0.00395	0.00198	0.00198
	0.00198	0.00988	0.09091	0.06917	0.02174	0.00593	0.00791	0.00593	0	0.00593	0.00198	0.00395	0	0	0	0.00395	
2008	1	1	3	0	1	1	52	24	0	0	0	0	0.03283	0.00897	0.04885	0.03108	0.68929
	0.04218	0.00763	0.00121	0.00017	0.0068	0	0.00058	0.0015	0.00092	0.00213	0.00092	0.0015	0	0	0	0	0.01702
	0.00375	0.02015	0.00104	0.0675	0.0108	0.00317	0	0	0	0	0	0	0	0	0	0	
2009	1	1	3	0	1	1	52	27	0	0	0	0.00281	0.03094	0.18847	0.07314	0.12377	0.01969
	0.32771	0.02954	0.00563	0.00985	0.01547	0.00563	0.00422	0.00141	0.00563	0.00141	0	0.00422	0	0	0	0.00141	0.00422
	0.03657	0.00985	0.02813	0.00422	0.04923	0.00985	0.00281	0.00141	0.00141	0	0.00141	0	0	0	0	0	
2010	1	1	3	0	1	1	52	9	0	0	0	0	0	0.00662	0.00662	0.01325	0.06954
	0.05629	0.4404	0.22185	0.05298	0.02649	0.02649	0.01656	0.00331	0	0	0	0.00993	0	0	0	0	0
	0	0.00993	0	0.00331	0.00993	0.01325	0.01325	0	0	0	0	0	0	0	0	0	

2011	1	1	3	0	1	1	52	3	0	0.33333	0	0	0	0	0	0	0.22222
	0	0	0.22222	0	0	0	0	0	0	0	0	0	0	0.22222	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2012	1	1	3	0	1	1	52	15	0	0	0.016	0.04623	0.0134	0.01405	0.0162	0.092	0.13213
	0.03105	0.0475	0.014	0.26862	0.01126	0	0.00819	0.00105	0	0	0	0	0	0.00817	0.00307	0	0.00105
	0.00412	0.00603	0.01899	0.04799	0.03176	0.02571	0.04532	0.08062	0.01133	0.00416	0	0	0	0	0	0	
2013	1	1	3	0	1	1	52	21	0	0	0.01651	0.13235	0.01206	0.01152	0	0.02	0.02285
	0.21725	0.0293	0.0957	0.01595	0.29409	0.0026	0	0	0	0	0	0	0	0.00003	0.01261	0.00992	0.00539
	0.0035	0	0.00172	0.02754	0.02631	0.00446	0.00742	0.00973	0.02115	0.00005	0	0	0	0	0	0	
2014	1	1	3	0	1	1	52	4	0	0	0	0.11667	0.17667	0.02667	0.00333	0.00667	0.01
	0.02333	0.11	0.04333	0.07	0.02667	0.23	0.01333	0	0.00333	0	0	0	0	0	0	0.03333	0.02
	0	0	0	0	0.00667	0.02333	0.00333	0.00667	0.01	0.03667	0	0	0	0	0	0	
#																	
#																	
#									Hook-line - females								
														Hook-line males			
#Hook and Line									# samples		1	2	3	4	5	6	7
	8	9	10	11	12	13	14	15	16	17	18	19	20	plus	1	2	3
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	plus																
1985	1	2	3	0	1	1	52	1	0	0	0	0	0	0.04536	0.05328	0.19343	0.05236
	0.11135	0.05757	0.2199	0.01276	0.10755	0.01731	0.05256	0.01011	0.00383	0	0.0445	0.01204	0	0	0	0	0
	0	0	0.00179	0	0	0	0	0.00086	0.00343	0	0	0	0	0	0	0	
1986	1	2	3	0	1	1	52	3	0	0	0.00204	0.00148	0	0.03329	0.04987	0.02766	0.1301
	0.09393	0.15182	0.082	0.19844	0.00591	0.07306	0.04547	0.0265	0.0038	0.04702	0.00225	0.00148	0.00004	0	0	0	0
	0	0.00732	0	0	0.00394	0.00183	0.00028	0.00232	0.00408	0.0019	0.00014	0.00204	0	0	0	0	
1987	1	2	3	0	1	1	52	7	0	0.02078	0	0.01888	0	0	0.00618	0.46082	0.0254
	0.0622	0.0127	0.0876	0.0127	0	0	0	0.0622	0	0.0622	0	0.00618	0	0	0	0.03158	0
	0	0	0	0	0	0	0.00618	0	0	0	0	0.0622	0	0.0622	0	0	

1990	1	2	3	0	1	1	52	11	0	0	0	0.1	0	0.6	0.3	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1991	1	2	3	0	1	1	52	17	0	0.00476	0.01476	0.02609	0.08713	0.10463	0.33351	0.06743	0.02424
	0.02449	0.02101	0.02871	0	0.01271	0.00142	0.00539	0	0.00273	0	0	0	0	0.00057	0.01381	0.02257	0.04766
	0.02672	0.06108	0.0148	0	0.0044	0.00532	0.01512	0	0.00692	0	0.00791	0	0.0099	0	0.00419	0	
1992	1	2	3	0	1	1	52	38	0	0	0.0014	0.03133	0.07605	0.13621	0.0988	0.22181	0.05191
	0.01575	0.02486	0.03549	0.02768	0.02943	0.00976	0.00214	0.00497	0.00063	0.008	0.0009	0.01247	0	0.00099	0.00055	0.01498	0.04606
	0.03756	0.02124	0.03045	0.00864	0.00296	0.01137	0.01003	0.00167	0.00978	0.00704	0.00023	0.00298	0.00272	0.00049	0	0.00066	
1993	1	2	3	0	1	1	52	20	0	0	0.06322	0.28475	0.18681	0.18307	0.08329	0.03099	0.04344
	0.00095	0.00031	0.00033	0.00986	0.00056	0.00009	0.00034	0.00006	0.00036	0.00041	0.00009	0.00029	0	0	0.00892	0.03631	0.00024
	0.00054	0.01886	0.01789	0.00957	0.00017	0.00014	0.00892	0.00008	0.00002	0.00879	0.00005	0	0.00002	0.0003	0	0	
1994	1	2	3	0	1	1	52	11	0	0	0.00204	0.01527	0.05033	0.06699	0.12842	0.13083	0.12713
	0.22705	0.03146	0.00527	0.02674	0.02452	0.01832	0.00342	0	0	0.00379	0	0.00629	0	0	0	0.0049	0.00981
	0.00833	0.01471	0.0049	0.01739	0.04386	0.00972	0	0.0049	0	0.0049	0	0	0	0	0	0.0087	
1995	1	2	3	0	1	1	52	8	0	0	0.00187	0.01532	0.02451	0.15618	0.20948	0.10585	0.06084
	0.01692	0.0284	0.00986	0	0.00475	0	0.00403	0	0	0.00029	0.00073	0	0	0	0	0	0.05106
	0.06784	0.07469	0.05575	0.02552	0.01207	0.02556	0.00579	0	0.01021	0.00402	0	0.00402	0	0.00029	0.00873	0.01542	
1996	1	2	3	0	1	1	52	11	0	0	0.00672	0.0158	0.08338	0.10917	0.13115	0.12225	0.13751
	0.06567	0.0743	0.0743	0.0139	0.00463	0	0	0	0	0.00427	0.00463	0	0	0	0	0.00336	0.01008
	0	0.00672	0.01553	0.01035	0.08919	0.00854	0.00854	0	0	0	0	0	0	0	0	0	
1997	1	2	3	0	1	1	52	10	0	0	0.04794	0.20447	0.08564	0.13285	0.15286	0.08235	0.08854
	0.03996	0.0217	0.02629	0.01015	0.00295	0.00769	0.00139	0	0.00729	0.00711	0	0.00121	0	0.01006	0.02013	0.00768	0
	0.01006	0.00768	0	0	0.00057	0	0.00768	0	0.00768	0	0.00809	0	0	0	0	0	
-1998	1	2	3	0	1	1	52	1	0	0	0.00213	0.02347	0.05733	0.06901	0.06024	0.08737	0.13578
	0.15112	0.08453	0.04459	0.03388	0.02155	0.005	0.00189	0.00189	0.00402	0.00991	0	0.00927	0	0	0	0	0
	0.01595	0.00601	0.02622	0.035	0.02812	0.02959	0.01547	0.00991	0.01179	0.01004	0.00189	0.00301	0.00213	0.00189	0	0	
-1999	1	2	3	0	1	1	52	1	0	0	0	0.04742	0.08607	0.37575	0.09088	0.0561	0.0608
	0.0513	0.07462	0.0102	0.00748	0.00669	0.00669	0	0.00079	0	0	0	0	0	0	0	0	0.00739
	0.05183	0.00942	0.01883	0.00079	0.00942	0	0.01338	0.00669	0.00079	0.00669	0	0	0	0	0	0	
-2000	1	2	3	0	1	1	52	1	0	0.00132	0.02549	0.0523	0.09041	0.13052	0.10797	0.0791	0.05472
	0.09137	0.01976	0.03555	0.00624	0.00059	0.00566	0.0152	0	0	0.00059	0	0	0	0	0	0.01373	0.01241
	0.05369	0.01579	0.01711	0.02931	0.03335	0.02255	0.0282	0.01579	0.01645	0	0.01241	0	0	0	0	0.01241	

-2001	1	2	3	0	1	1	52	1	0	0	0	0.00172	0.01954	0.01552	0.01753	0.10458	0.04813
	0.07298	0.04295	0.00172	0.01451	0.01451	0.00891	0.00891	0	0	0	0	0.00891	0	0	0	0.00891	0.01781
	0.04683	0.09869	0.12771	0.03793	0.08648	0.04683	0.02902	0.05804	0	0.01451	0.02342	0	0.02342	0	0	0	
-2002	1	2	3	0	1	1	52	1	0	0	0.02632	0	0.05263	0	0.05263	0.05263	0.02632
	0	0	0	0	0	0	0.02632	0	0.02632	0	0	0	0	0	0	0	0
	0.07895	0	0.10526	0.18421	0.13158	0.07895	0.10526	0	0.02632	0	0	0.02632	0	0	0	0	
#																	
#																	
#									Net - females								
													net - males				
#Net								# samples		1	2	3	4	5	6	7	8
	9	10	11	12	13	14	15	16	17	18	19	20	plus	1	2	3	4
	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	plus
-1983	1	3	3	0	1	1	52	-1	0	0	0	0	0.02676	0.04003	0.09744	0.18161	0.13584
	0.15997	0.09485	0.05798	0.01296	0.08973	0	0.0265	0	0	0	0	0	0	0	0	0	0
	0.01353	0	0.03788	0	0.02491	0	0	0	0	0	0	0	0	0	0	0	
1984	1	3	3	0	1	1	52	7	0	0	0	0	0	0	0.10225	0.10225	0.23027
	0.23108	0.14895	0.05153	0	0.05636	0.02576	0	0.01047	0	0	0.04106	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1985	1	3	3	0	1	1	52	36	0	0	0	0	0.0004	0.04985	0.03887	0.06337	0.05768
	0.11556	0.11659	0.18543	0.13259	0.06512	0.02013	0.01098	0.04088	0.0085	0.02041	0.00005	0.00264	0	0	0	0.00033	0
	0.00323	0.00046	0.00367	0.00463	0.00705	0.00807	0.00897	0.0089	0.00199	0	0.0041	0.00195	0	0.00965	0.00523	0.00269	
1986	1	3	3	0	1	1	52	41	0	0.00039	0.0003	0.00022	0.00023	0.01824	0.10149	0.0392	0.1235
	0.14438	0.12603	0.08913	0.05311	0.01379	0.07571	0.0592	0.02077	0.03545	0.00555	0.00722	0.02524	0	0	0	0.00006	0.00006
	0.00502	0.00612	0.00573	0.01498	0.00355	0.00317	0.0015	0.00735	0.00351	0.00049	0.00555	0	0.00269	0.00026	0.00057	0.00026	
1987	1	3	3	0	1	1	52	63	0	0	0.00408	0.0086	0.02549	0.02475	0.06117	0.20162	0.06769
	0.03134	0.10648	0.17654	0.04042	0.0921	0.00948	0.01664	0.01234	0.00956	0	0.00945	0.00641	0.00019	0	0.00204	0.00496	0.00241
	0.00048	0.00582	0.03464	0.00774	0.00259	0.00245	0.01552	0.00274	0.01393	0	0.00007	0.00019	0	0	0.00007	0	

1988	1	3	3	0	1	1	52	42	0	0	0.00067	0.1144	0.00112	0.00482	0.02916	0.03724	0.14749
	0.04565	0.03701	0.07402	0.26009	0.00213	0.04172	0	0.02535	0	0.01009	0	0.07133	0	0.00101	0	0.04744	0.00101
	0.00168	0	0.00168	0.00594	0.00202	0	0.00112	0.0323	0.00112	0.00101	0	0	0.00135	0	0	0	
1989	1	3	3	0	1	1	52	68	0	0	0.00031	0.04789	0.41627	0	0.00348	0.00234	0.03069
	0.33092	0.00052	0.03721	0.01504	0.04579	0.01175	0.01738	0.00009	0	0.01224	0	0	0	0	0	0.00006	0.01467
	0.00003	0	0.00003	0.00031	0.00065	0	0.00003	0.00043	0	0.01153	0	0.00012	0.00022	0	0	0	
1990	1	3	3	0	1	1	52	79	0	0.00227	0.00965	0.01093	0.0132	0.27502	0.04884	0.00185	0.00554
	0.12338	0.09399	0.04657	0.01903	0.0389	0.06318	0.00014	0.03748	0.00043	0	0	0.00014	0	0	0.00099	0.00426	0.00114
	0.05594	0.00852	0.04089	0.00057	0.00781	0.00753	0.04572	0.00142	0.0017	0.00838	0.00199	0.00227	0.00014	0.00014	0.00057	0.01945	
1991	1	3	3	0	1	1	52	7	0	0	0.01502	0.01502	0.08834	0.11352	0.40592	0.08216	0
	0.02606	0.00221	0.01193	0	0.00928	0	0.02385	0	0	0	0	0	0	0	0.03004	0.00221	0.04373
	0.01413	0.06537	0.00707	0	0	0	0.03224	0	0	0	0	0	0.01193	0	0	0	
-1992	1	3	3	0	1	1	52	1	0	0	0	0.01552	0.06707	0.03244	0.08285	0.26658	0.07167
	0.01541	0.07176	0.04182	0.03368	0.0175	0.01385	0.01981	0.02353	0.01624	0.01472	0	0.00251	0	0	0.00048	0.01162	0.00295
	0.01433	0.02943	0.07371	0.00964	0.00145	0	0.016	0.00531	0.00491	0.01054	0	0.00645	0.00075	0.00546	0	0	
1993	1	3	3	0	1	1	52	12	0	0	0	0.01679	0.03743	0.04886	0.10278	0.11866	0.28306
	0.04927	0.02559	0.05382	0.05969	0.05412	0.01487	0.02802	0.00344	0.01325	0	0	0	0	0	0.00233	0.00465	0.017
	0.01254	0.00718	0.00799	0.02226	0	0	0.00303	0	0	0.00132	0.00223	0	0.00981	0	0	0	
1994	1	3	3	0	1	1	52	9	0	0	0	0	0.01278	0.07036	0.10557	0.13574	0.12117
	0.23743	0.02058	0.02415	0.05076	0.04652	0.01438	0.00504	0.0153	0.00719	0	0	0	0	0	0.00633	0.00922	0.00596
	0.00547	0.01008	0.02065	0.00922	0.03343	0	0	0	0	0.00811	0.01997	0	0	0	0	0.00461	
1995	1	3	3	0	1	1	52	3	0	0	0	0	0.0212	0.0212	0.0424	0.09385	0.0212
	0.16669	0.30604	0.05738	0.03618	0.05955	0.04381	0.04787	0.03072	0.03072	0	0	0	0	0	0	0	0
	0	0	0	0	0.0212	0	0	0	0	0	0	0	0	0	0	0	
1996	1	3	3	0	1	1	52	2	0	0	0	0	0.03388	0	0.03388	0.13553	0.11862
	0.08474	0.06776	0.23737	0	0.03388	0	0.03388	0.06783	0.05092	0.05086	0	0.01697	0	0	0	0	0
	0	0	0	0	0.03388	0	0	0	0	0	0	0	0	0	0	0	
1997	1	3	3	0	1	1	52	2	0	0	0	0	0.05571	0	0.02455	0.09254	0.13598
	0.23513	0.09537	0.16619	0	0.03683	0.03399	0	0.01228	0	0.01228	0	0	0	0	0	0	0
	0	0	0.02172	0	0.02172	0	0.02172	0	0	0.01228	0	0	0	0	0	0.02172	
1998	1	3	3	0	1	1	52	3	0	0	0	0	0	0	0.0377	0.06604	0.16985
	0.11951	0.19811	0.0786	0.10374	0.11006	0	0	0	0	0.02513	0	0.00945	0	0	0	0	0
	0	0.00945	0	0.02201	0	0	0.00945	0.03146	0.00945	0	0	0	0	0	0	0	

#

#year	season	type	gender	part	errmat	Lbinlo	LbinHi	#samples		1	2	3	4	5	6	7	8
	9	10	11	12	13	14	15	16	17	18	19	20	21	1	2	3	4
	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1983	1	5	3	0	1	1	52	20	0	0.00272	0.09673	0.17847	0.07901	0.02316	0.02724	0.00953	0.00681
	0.00953	0.00136	0.00545	0.00545	0.00408	0.00681	0.00272	0.00136	0	0	0	0.00272	0	0.00408	0.07901	0.23024	0.0831
	0.02861	0.02179	0.02997	0.01498	0.00817	0.00545	0.00545	0.00408	0.00272	0.00817	0.00136	0.00136	0	0	0.00136	0.00681	
1992	1	5	3	0	1	1	52	28	0.0813	0.11788	0.07723	0.0813	0.06504	0.04065	0.00813	0.03658	0
	0.00406	0.00813	0.00406	0.01626	0	0.00406	0	0	0	0	0	0.00406	0.08536	0.10162	0.07723	0.05284	0.03252
	0.00406	0.00813	0.04065	0	0.00813	0	0.00813	0.00813	0	0.01219	0.00813	0	0.00406	0	0	0	
1998	1	5	3	0	1	1	52	43	0.02517	0.04576	0.06636	0.0183	0.07322	0.02746	0.02288	0.01601	0.0183
	0.06636	0.01601	0.02746	0.00457	0.00686	0.00457	0.00228	0.00457	0	0	0.00228	0.00228	0.02746	0.04805	0.04347	0.03203	0.06865
	0.02288	0.04347	0.03203	0.0389	0.06407	0.05034	0.03203	0.00686	0.00686	0.00915	0.00686	0.00457	0.00228	0.00457	0	0.00457	
2001	1	5	3	0	1	1	52	46	0.05567	0.17732	0.03711	0.01855	0.03711	0.05773	0.02474	0.02268	0.00412
	0.02061	0.00618	0.02061	0.00412	0.01031	0.00618	0.00412	0.00412	0	0	0.00412	0.00412	0.05979	0.16494	0.03711	0.01855	0.01237
	0.0536	0.0268	0.04536	0.01649	0.01031	0.00206	0.00206	0.01443	0.00824	0	0.00412	0.00206	0.00206	0	0	0	

combo survey

#year	season	type	gender	part	errmat	Lbinlo	LbinHi	#samples		1	2	3	4	5	6	7	8
	9	10	11	12	13	14	15	16	17	18	19	20	21	1	2	3	4
	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
2003	1	6	3	0	1	1	52	85	0.02057	0.03889	0.03122	0.44215	0.04533	0.00106	0.01377	0.00119	0.00874
	0.00068	0.00055	0.00092	0.00000	0.00000	0.00039	0.00000	0.00025	0.00000	0.00000	0.00000	0.00000	0.01014	0.03218	0.00622	0.28680	0.02409
	0.00356	0.00163	0.00302	0.02404	0.00147	0.00007	0.00000	0.00020	0.00035	0.00050	0.00003	0.00000	0.00000	0.00000	0.00000	0.00000	
2004	1	6	3	0	1	1	52	79	0.05116	0.07041	0.04561	0.00241	0.30410	0.02337	0.01191	0.00445	0.01883
	0.00351	0.00648	0.00036	0.00066	0.00000	0.00015	0.00000	0.00083	0.00041	0.00000	0.00005	0.00011	0.04695	0.03601	0.06583	0.01059	0.24146
	0.02737	0.02189	0.00078	0.00130	0.00000	0.00037	0.00037	0.00000	0.00000	0.00050	0.00082	0.00053	0.00037	0.00000	0.00005	0.00000	
2005	1	6	3	0	1	1	52	84	0.01539	0.03333	0.00958	0.01603	0.04164	0.39247	0.05223	0.01149	0.00090
	0.00389	0.00100	0.00629	0.00022	0.00102	0.00000	0.00004	0.00024	0.00210	0.00038	0.00140	0.00352	0.02172	0.04526	0.00721	0.01242	0.00594
	0.28139	0.01113	0.00249	0.00403	0.00171	0.00647	0.00467	0.00007	0.00020	0.00030	0.00007	0.00090	0.00038	0.00042	0.00003	0.00004	
2006	1	6	3	0	1	1	52	68	0.00093	0.00977	0.06893	0.00942	0.04112	0.00985	0.21720	0.03947	0.00861
	0.00094	0.01745	0.00943	0.00914	0.00034	0.00012	0.00008	0.00359	0.00560	0.00000	0.00000	0.00023	0.00083	0.00558	0.05537	0.06580	0.03992
	0.01264	0.23115	0.10689	0.02607	0.00000	0.00015	0.00000	0.00009	0.00321	0.00000	0.00008	0.00000	0.00000	0.00000	0.00000	0.00000	

2007	1	6	3	0	1	1	52	67	0.00267	0.00377	0.01543	0.02084	0.04447	0.14753	0.03351	0.30620	0.01851
	0.00000	0.00000	0.01918	0.00012	0.00036	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00110	0.00126	0.00360	0.02662	0.02833
	0.00196	0.01435	0.22538	0.01722	0.00483	0.02635	0.00021	0.00082	0.00000	0.02707	0.00000	0.00000	0.00082	0.00021	0.00000	0.00728	
2008	1	6	3	0	1	1	52	80	0.01959	0.00170	0.00218	0.01662	0.05900	0.00678	0.01620	0.00461	0.33240
	0.01783	0.00022	0.00000	0.03040	0.00170	0.00386	0.00099	0.00180	0.00000	0.00162	0.00083	0.00179	0.02622	0.00989	0.01087	0.02380	0.09340
	0.03365	0.03386	0.02500	0.16862	0.01667	0.01398	0.00077	0.02251	0.00016	0.00049	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
2009	1	6	3	0	1	1	52	76	0.01378	0.03502	0.01012	0.00000	0.02393	0.07512	0.00805	0.01613	0.00644
	0.15363	0.00295	0.00130	0.00511	0.00040	0.00946	0.00318	0.00000	0.00280	0.00000	0.00072	0.00050	0.01401	0.03723	0.00397	0.00528	0.01011
	0.10005	0.11882	0.08999	0.01647	0.18501	0.02922	0.00023	0.00028	0.00620	0.00123	0.00280	0.00099	0.00946	0.00000	0.00000	0.00000	
2010	1	6	3	0	1	1	52	106	0.22787	0.05341	0.07275	0.00593	0.00355	0.01070	0.01936	0.00630	0.01593
	0.01950	0.07768	0.00200	0.00016	0.00000	0.00145	0.00000	0.00114	0.00000	0.00000	0.00000	0.00000	0.27674	0.04893	0.03475	0.00127	0.00513
	0.01064	0.02897	0.01621	0.00833	0.00953	0.03443	0.00734	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
2011	1	6	3	0	1	1	52	80	0.12652	0.25154	0.03229	0.05244	0.00006	0.00164	0.03282	0.03532	0.02853
	0.00139	0.00159	0.06286	0.02935	0.00064	0.00143	0.00000	0.00127	0.00000	0.00000	0.00000	0.00000	0.07659	0.12389	0.01021	0.00078	0.02738
	0.00184	0.00486	0.01185	0.03202	0.00339	0.03612	0.01130	0.00004	0.00000	0.00004	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
2012	1	6	3	0	1	1	52	103	0.03678	0.19865	0.14359	0.02736	0.04659	0.00076	0.02024	0.02418	0.00578
	0.00399	0.00286	0.00783	0.02851	0.00104	0.00158	0.00143	0.00017	0.00006	0.00000	0.00000	0.00000	0.06250	0.11427	0.19457	0.00263	0.00697
	0.00197	0.00041	0.00129	0.00543	0.00920	0.00691	0.00270	0.01671	0.02143	0.00024	0.00013	0.00000	0.00000	0.00000	0.00000	0.00125	
2013	1	6	3	0	1	1	52	91	0.03330	0.01677	0.23603	0.12445	0.03790	0.02487	0.00373	0.00289	0.00595
	0.01705	0.00782	0.01018	0.00420	0.02775	0.00122	0.00000	0.00158	0.00000	0.00000	0.00007	0.00009	0.02012	0.01734	0.23582	0.07632	0.01423
	0.00590	0.00022	0.00000	0.00243	0.02567	0.01262	0.00080	0.01639	0.01591	0.00038	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
2014	1	6	3	0	1	1	52	126	0.09755	0.01237	0.00900	0.14920	0.06309	0.07030	0.00832	0.00055	0.00010
	0.00079	0.00193	0.00094	0.00018	0.00133	0.00326	0.00028	0.00000	0.00000	0.00000	0.00000	0.00000	0.07820	0.00828	0.02550	0.08522	0.10635
	0.00343	0.00151	0.00004	0.00055	0.00365	0.00253	0.00000	0.06564	0.03311	0.13390	0.03280	0.00010	0.00000	0.00000	0.00000	0.00000	

#

#
MEAN SIZE-AT-AGE

-1 #_number of size-at-age observations; negative value excludes from likelihood
ENVIRONMENTAL DATA
----
0 #_number of environmental variables
0 #_number of environmental observations
0 # no wtfreq data

0 # no tag data
0 # no morphcomp data

#
999 #_end of data file

CONTROL FILE

```
# ****************************************************************
#  Chilipepper rockfish .ctl file
#  final model from May 2015 assessment update
#  SS3 Version 3.20 by_Richard_Methot_(NOAA);_using_Otter_Research_ADMB_7.0.1
# ****************************************************************
#
#
1       #_N_Growth_Patterns
1       #_N_submorphs
3       #_Nblock_Designs
5 10 1  #_blocks_per_pattern

# block design 1
1970 1979
1980 1988
1989 1991
1992 1998
1999 2014
#2004 2014
#2009 2015

# block design 2
1972 1977
1978 1980
1981 1983
1984 1986
1987 1989
1990 1992
1993 1995
1996 1998
1999 2001
2002 2006
```

```
# block design 3
2003 2014

0.5     #_fracfemale
0       #_natM_type:_0=1Parm; 1=N_breakpoints;_2=Lorenzen;_3=agespecific;_4=agespec_withseasinterpolate

1       # GrowthModel: 1=vonBert with L1&L2; 2=Richards with L1&L2; 3=not implemented; 4=not implemented
2       #_Growth_Age-at-L1 (Amin)
18      #_Growth_Age-at-L2 (Amax)
0       #_SD_add_to_LAA (set equal to 0.1 to mimic SS2 v1.xx)
0       #_CV_Growth_Pattern (0: CV=f(LAA) 1: CV=f(A) 2: SD=f(LAA) 3: SD=f(A))

1       #_maturity_option:  1=length logistic; 2=age logistic; 3=read age-maturity matrix by growth_pattern; 4=read age-fecundity; 5=read fec and wt from
wtatage.ss
1       #_First_Mature_Age
1       #_fecundity option:(1)eggs=Wt*(a+b*Wt);(2)eggs=a*L^b;(3)eggs=a*Wt^b
0       #_hermaphroditism option:  0=none; 1=age-specific fxn
2       #_parameter_offset_approach (1=none, 2= M, G, CV_G as offset from female-GP1, 3=like SS2 V1.x)
1       #_env/block/dev_adjust_method (1=standard; 2=logistic transform keeps in base parm bounds; 3=standard w/ no bound check)

#_growth_parms
#_LO    HI      INIT    PRIOR   PR_type SD      PHASE   env-var use_dev dev_minyr dev_maxyr dev_stddev Block Block_Fxn
0.05    0.3     0.16    0.22    0       0.8     -4      0       0       0       0       0.5     0       0 #_Gpattern:_1_Gender:_1
15      30      19.659  19.659  0       20      -4      0       0       0       0       0.5     0       0
25      70      47.3    47.3    0       20      -2      0       0       0       0       0.5     0       0
0.05    0.3     0.1945  0.1945  0       0.8     -2      0       0       0       0       0.5     1       0
0.02    0.3     0.06    0.06    0       0.8     -2      0       0       0       0       0.5     0       0
0.02    0.3     0.06    0.06    0       0.8     -2      0       0       0       0       0.5     0       0

-6      3       0.232   0.1279  0       0.8     -4      0       0       0       0       0.5     0       0 #_Gpattern:_1_Gender:_2
-6      3       -0.03   -0.03   0       0.8     -4      0       0       0       0       0.5     0       0
-3      3       -0.35   -0.35   0       0.8     -2      0       0       0       0       0.5     0       0
-3      3       0.605   0.605   0       0.8     -2      0       0       0       0       0.5     0       0
-3      3       0       0       0       0.8     -2      0       0       0       0       0.5     0       0
-3      3       0       0       0       0.8     -2      0       0       0       0       0.5     0       0
```

```
-3	3	4.05e-006 4.1e-006	0	0	-3	0	0	0	0	0.5	0	0	#_wt-len-intercept female
-3	10	3.2	3.25	0	0.5	-3	0	0	0	0	0.5	0	0	#_wt-len-exponent female
1	50	24.4	25	0	0.8	-3	0	0	0	0	0.5	0	0	#_Maturity: Length-inflection
-3	3	-0.27	-0.3	0	0.8	-3	0	0	0	0	0.5	0	0	#_Maturity: Slope; negative value required
#1	50	25.713	25	0	0.8	-3	0	0	0	0	0.5	0	0	#_Maturity: Length-inflection
#-3	3	-0.316 -0.3	0	0.8	-3	0	0	0	0	0.5	0	0	#_Maturity: Slope; negative value required
-3	300	132.355 132.355 0	0.8	-3	0	0	0	0	0.5	0	0	#_Fecundity: eggs/gm intercept - from Beyer et al., He et al.
-3	100	59	59	0	0.8	-3	0	0	0	0	0.5	0	0	#_Fecundity: eggs/gm slope from Beyer et al., He et al.
#-3	3	1	1	0	0.8	-3	0	0	0	0	0.5	0	0	#_Fecundity: eggs/gm intercept
#-3	3	0	0	0	0.8	-3	0	0	0	0	0.5	0	0	#_Fecundity: eggs/gm slope
-3	3	2.24e-006 2.2e-006	0	0	-3		0	0	0	0	0.5	0	0	#_wt-len-intercept male
-3	10	3.32	3.32	0	0.05	-3	0	0	0	0	0.5	0	0	#_wt-len-exponent male

-4	4	0	0	-1	99	-3	0	0	0	0	0.5	0	0 #_recrdistribution_by_growth_pattern
-4	4	0	0	-1	99	-3	0	0	0	0	0.5	0	0 #_recrdistribution_by_area 1
-4	4	4	0	-1	99	-3	0	0	0	0	0.5	0	0 #_recrdistribution_by_season 1
1	1	1	1	-1	99	-3	0	0	0	0	0.5	0	0 #_cohort_growth_deviation

#
#_Cond 0  #custom_MG-env_setup (0/1)
#_Cond -2 2 0 0 -1 99 -2 #_placeholder when no MG-environ parameters
#
#_Cond 0  #custom_MG-block_setup (0/1)
#_Cond -2 2 0 0 -1 99 -2 #_placeholder when no MG-block parameters
#_Cond No MG parm trends
#

# Growth K blocks
1  #custom_MG-block_setup (0/1)
```

#_LO	HI	INIT	PRIOR	PR_type	SD	PHASE
-10	10	0	0	0	0.5	5
-10	10	0	0	0	0.5	5
-10	10	0	0	0	0.5	5
-10	10	0	0	0	0.5	5
-10	10	0	0	0	0.5	5
#-10	10	0	0	0	0.5	5
#-10	10	0	0	0	0.5	5

#_seasonal_effects_on_biology_parms
0 0 0 0 0 0 0 0 0 0 #_femwtlen1,femwtlen2,mat1,mat2,fec1,fec2,Malewtlen1,malewtlen2,L1,K

#_Spawner-Recruitment
3 #_SR_function: 2=Ricker; 3=std_B-H; 4=SCAA; 5=Hockey; 6=B-H_flattop; 7=survival_3Parm

#_LO	HI	INIT	PRIOR	PR_type	SD	PHASE	
5	15	10.5	10.5	0	5	1	# SR_LN(R0)
0.2	1	0.81	0.573	0	0.183	-4	# SR_BH_steep
0	2	1	1	0	1	-3	# SR_sigmaR
-5	5	0	0	0	1	-3	# SR_envlink
-5	5	0	0	0	1	-3	# SR_R1_offset
0	0.5	0	0	-1	99	-2	# SR_autocorr

0 #_SR_env_link
0 #_SR_env_target_0=none;1=devs;_2=R0;_3=steepness

1 # do_recdev: 0=none; 1=devvector; 2=simple deviations
1965 # first year of main recr_devs; early devs can preceed this era
2014 # last year of main recr_devs; forecast devs start in following year
2 #_recdev phase

0 # (0/1) to read 13 advanced options
#1950 #_recdev_early_start (0=none; neg value makes relative to recdev_start)
#3 #_recdev_early_phase
#0 #_forecast_recruitment phase (incl. late recr) (0 value resets to maxphase+1)
#1 #_lambda for Fcast_recr_like occurring before endyr+1
#1950 #_last_early_yr_nobias_adj_in_MPD

#1950 #_first_yr_fullbias_adj_in_MPD
#2006 #_last_yr_fullbias_adj_in_MPD
#2006 #_first_recent_yr_nobias_adj_in_MPD
#1.0 #_max_bias_adj_in_MPD (-1 to override ramp and set biasadj=1.0 for all estimated recdevs)
#0 #_period of cycles in recruitment (N parms read below)
#-3 #min rec_dev
#3 #max rec_dev
#0 #_read_recdevs
#_end of advanced SR options
#

#Fishing Mortality info
0.5 # F ballpark for tuning early phases
2006 # F ballpark year
1 # F_Method: 1=Pope; 2=instan. F; 3=hybrid (hybrid is recommended)
0.9 # max F or harvest rate, depends on F_Method
no additional F input needed for Fmethod 1
read overall start F value; overall phase; N detailed inputs to read for Fmethod 2
read N iterations for tuning for Fmethod 3 (recommend 3 to 7)
if FMethod=2 (instan.), active next line
0.1 4 0 # overall start F value; overall phase; N detailed inputs to read

Number of tuning iterations in hybrid F: 4 or 5 may be good - check how catches data match estimated catches
if FMethod=3 (hybrid), active next line: phase for FMothod=3
4 #_Phase for FMethod=3

#_initial_F_parms

#_LO	HI	INIT	PRIOR	PR_type	SD	PHASE
0	0.1	0	0.01	0	0.2	-1
0	0.1	0	0.05	0	0.2	-1
0	1	0	0	0	0.2	-1
0	1	0	0	0	0.2	-1

Q_setup details: for columns A, B, C, D
A = do power: 0=skip, index is proportional to abundance, 1= add an extra parameter for non-linearity

B = envir links: 0=skip, 1= add parameter for envior effect on Q
C = extra SD: 0=skip, 1= add additional parameter for additive constant to input SE (in ln space)
D = Q type: <0=mirror lower abs(#) fleet, 0=no par Q is median unbiased, 1=no par Q is mean unbiased, 2=estimate par for ln(Q)
3 = ln(Q) + set of devs about ln(Q) for all years. 4=ln(Q) + set of devs about Q for indexyr-1

D definition in SS3 (devtype): <0=mirror, 0=float_nobiasadj, 1=float_biasadj, 2=parm_nobiasadj, 3=parm_w_random_dev, 4=parm_w_randwalk, 5=mean_unbiased_float_assign_to_parm
#_for_env-var:_enter_index_of_the_env-var_to_be_linked

#_Q_setup
Q_type options: <0=mirror, 0=float_nobiasadj, 1=float_biasadj, 2=parm_nobiasadj, 3=parm_w_random_dev, 4=parm_w_randwalk, 5=mean_unbiased_float_assign_to_parm
#_for_env-var:_enter_index_of_the_env-var_to_be_linked
#_Den-dep env-var extra_se Q_type
#_A B   C   D
0 0 0 0 # 1 trawl
0 0 0 0 # 2 hookline
0 0 0 0 # 3 setnet
0 0 0 0 # 4 rec
0 0 0 0 # 5 triennial
0 0 0 0 # 6 combined
0 0 0 0 # 7 juvsurvey
0 0 0 0 # 8 calcofi
0 0 0 0 # 9 juv2
0 0 0 0 # 10 ghost

#_size_selex_types
#_Pattern Discard Male Special

1	0	1	0	# 1
1	0	1	0	# 2
24	0	0	0	# 3
24	0	0	0	# 4
1	0	0	0	# 5
1	0	0	0	# 6

0	0	0	0	# 7
0	0	0	0	# 8
30	0	0	0	# 9
24	0	0	0	# 10

#_age_selex_types
#_Pattern Discard Male Special
10 0 0 0 # 1
10 0 0 0 # 2
10 0 0 0 # 3
10 0 0 0 # 4
10 0 0 0 # 5
10 0 0 0 # 6
11 0 0 0 # 7
11 0 0 0 # 8
10 0 0 0 # 9
20 0 1 0 # 10

#_selex_parms
#_size_sel: 1
#size sel 1 logistic

#LO	HI	INIT	PRIOR	PR_type	SD	PHASE	enVar	use_dev	dvMiYr	dvMxYr	dvStd	Block	Block_Fxn	
5	50	40.28	30	0	100	2	0	0	0	0	0	0	0	#
0.0001	35	14.31	5	0	10	3	0	0	0	0	0	0	0	#
1	60	10	11	0	100	-5	0	0	0	0	0.5	0	0	# male offset size@dogleg
-10	10	0	0	0	10	-5	0	0	0	0	0.5	0	0	# male offset log(relmalesel) at minL
-10	10	0	0	0	10	-5	0	0	0	0	0.5	0	0	# male offset log(relmalesel) at dogleg
-10	10	0	0	0	10	-5	0	0	0	0	0.5	0	0	# male offset log(relmalesel) at maxL

#_size_sel: 2

#LO	HI	INIT	PRIOR	PR_type	SD	PHASE	enVar	use_dev	dvMiYr	dvMxYr	dvStd	Block	Block_Fxn	
5	45	45	40	0	10	2	0	0	0	0	0	0	0	#

```
0.0001 35 14.31 5 0 10 2 0 0 0 0 0 0 0 #
1 60 16 20 0 10 -5 0 0 0 0 0.5 0 0 # male offset size@dogleg
-10 10 0 0 0 10 -5 0 0 0 0 0.5 0 0 # male offset log(relmalesel)at
minL
-10 10 0 0 0 10 -5 0 0 0 0 0.5 0 0 # male offset log(relmalesel)at
dogleg
-10 10 0 0 0 10 -5 0 0 0 0 0.5 0 0 # male offset log(relmalesel) at
maxL

# size sel 3
#5 45 45 40 0 10 2 0 0 0 0 0 0 0 #
#0.0001 35 14.31 5 0 10 2 0 0 0 0 0 0 0 #
#LO HI INIT PRIOR PR_type SD PHASE enVar use_dev dvMiYr dvMxYr dvStd Block Block_Fxn
19 51 45.17 50 0 100 2 0 0 0 0 0.5 0 0 # PEAK value
-6 6 -2.19 -0.75 0 10 4 0 0 0 0 0.5 0 0 # TOP logistic
-1 9 3.87 3.5 0 10 2 0 0 0 0 0.5 0 0 # WIDTH exp
-1 9 1.98 5 0 10 4 0 0 0 0 0.5 0 0 # WIDTH exp
-50 9 -4.76 -4.5 0 10 2 0 0 0 0 0.5 0 0 # INIT logistic
-50 9 -0.54 2.9 0 10 2 0 0 0 0 0.5 0 0 # FINAL logistic

#1 60 16 20 0 10 -5 0 0 0 0 0.5 0 0 # male offset size@dogleg
#-10 10 0 0 0 10 -5 0 0 0 0 0.5 0 0 # male offset log(relmalesel)at
minL
#-10 10 0 0 0 10 -5 0 0 0 0 0.5 0 0 # male offset log(relmalesel)at
dogleg
#-10 10 0 0 0 10 -5 0 0 0 0 0.5 0 0 # male offset log(relmalesel) at
maxL

#_size_sel: 4
#LO HI INIT PRIOR PR_type SD PHASE enVar use_dev dvMiYr dvMxYr dvStd Block Block_Fxn
19 51 33.85 32 0 10 2 0 0 0 0 0.5 3 0 # PEAK value
-20 4 -1.27 -0.75 0 10 2 0 0 0 0 0.5 3 0 # TOP logistic
-10 9 3.4 3.5 0 10 2 0 0 0 0 0.5 3 0 # WIDTH exp
-10 9 3.68 5 0 10 2 0 0 0 0 0.5 3 0 # WIDTH exp
-10 9 -3.37 -4.5 0 10 2 0 0 0 0 0.5 3 0 # INIT logistic
```

```
-10     9       0.79    2.9     0       10      2       0       0       0       0       0.5     3       0       #       FINAL   logistic

#_size_sel: 5
#LO     HI      INIT    PRIOR   PR_type SD      PHASE   enVar   use_dev dvMiYr  dvMxYr  dvStd   Block   Block_Fxn
5       35      15.7    25.7    0       10      -2      0       0       0       0       0       0       0       #
0.0001  35      0.0002  5       0       10      -2      0       0       0       0       0       0       0       #

# size sel 6
#LO     HI      INIT    PRIOR   PR_type SD      PHASE   enVar   use_dev dvMiYr  dvMxYr  dvStd   Block   Block_Fxn
5       35      20      15      0       100     2       0       0       0       0       0       0       0       #
0.0001  35      14      5       0       10      2       0       0       0       0       0       0       0       #

#_size_sel: 7,8 - none- pre recruit survey
#_size_sel: 9 set to maturity-
#_size_sel: 10 Rec CPUE
#LO     HI      INIT    PRIOR   PR_type SD      PHASE   enVar   use_dev dvMiYr  dvMxYr  dvStd   Block   Block_Fxn
19      51      33.85   32      0       100     2       0       0       0       0       0.5     0       0       #       PEAK    value
-6      4       -1.27   -0.75   0       10      2       0       0       0       0       0.5     0       0       #       TOP     logistic
-1      9       3.4     3.5     0       10      2       0       0       0       0       0.5     0       0       #       WIDTH exp
-1      9       3.68    5       0       10      2       0       0       0       0       0.5     0       0       #       WIDTH exp
-10     9       -3.37   -4.5    0       10      2       0       0       0       0       0.5     0       0       #       INIT    logistic
-10     9       0.79    2.9     0       10      2       0       0       0       0       0.5     0       0       #       FINAL   logistic

# size_se1: 10- male offsets- 4 lines
#1      60      16      20      0       10      -5      0       0       0       0       0.5     0       0       #       size@dogleg
#-10    10      0       0       0       10      -5      0       0       0       0       0.5     0       0       #       log(relmalesel)at minL
#-10    10      0       0       0       10      -5      0       0       0       0       0.5     0       0       #       log(relmalesel)at dogleg
#-10    10      0       0       0       10      -5      0       0       0       0       0.5     0       0       #       log(relmalesel) at maxL
#
#
#_age_sel: 1
#_age_sel: 2
#_age_sel: 3
#_age_sel: 5
#_age_sel: 6
```

```
#_age_sel: 7 - juv survey 1
#LO	HI	INIT	PRIOR	PR_type	SD	PHASE	enVar	use_dev	dvMiYr	dvMxYr	dvStd	Block	Block_Fxn
0	0	0	0	0	10	-3	0 0 0 0 0 0 0 # 39
0	0	0	0	0	10	-3	0 0 0 0 0 0 0 # 40
#_age_sel: 8 - juv survey 2
#LO	HI	INIT	PRIOR	PR_type	SD	PHASE	enVar	use_dev	dvMiYr	dvMxYr	dvStd	Block	Block_Fxn
0	0	0	0	0	10	-3	0 0 0 0 0 0 0 # 39
0	0	0	0	0	10	-3	0 0 0 0 0 0 0 # 40

#LO	HI	INIT	PRIOR	PR_type	SD	PHASE	enVar	use_dev	dvMiYr	dvMxYr	dvStd	Block	Block_Fxn
1	10	1.113	1	0	1	-2	0	0	0	0	0.5	0	0	#	PEAK	value
-60	60	-59.9	-23	0	1	-2	0	0	0	0	0.5	0	0	#	TOP	logistic
-40	20	-24.8	-20	0	1	-2	0	0	0	0	0.5	0	0	#	WIDTH exp
-40	10	-0.12	0	0	1	-3	0	0	0	0	0.5	0	0	#	WIDTH exp
-40	10	-33.5	-17	0	1	-2	0	0	0	0	0.5	0	0	#	INIT	logistic
-40	20	-4.11	-4.5	0	1	-2	0	0	0	0	0.5	0	0	#	FINAL	logistic

# agesel 10- male offsets- 4 lines
#LO	HI	INIT	PRIOR	PR_type	SD	PHASE	enVar	use_dev	dvMiYr	dvMxYr	dvStd	Block	Block_Fxn
1	60	2	2	0	1	-5	0	0	0	0	0.5	0	0	#	size@dogleg
-10	10	0	0	0	1	-5	0	0	0	0	0.5	0	0	#	log(relmalesel)at minL
-10	10	0	0	0	1	-5	0	0	0	0	0.5	0	0	#	log(relmalesel)at dogleg
-10	10	0	0	0	1	-5	0	0	0	0	0.5	0	0	#	log(relmalesel) at maxL

#1	#_env/block/dev_adjust_method (1=standard; 2=logistic trans to keep in base parm bounds; 3=standard w/ no bound check)

1  #custom_MG-block_setup (0/1)
-3	2	0	0	-1	99	4 #
-3	2	0	0	-1	99	4 #
-3	2	0	0	-1	99	4 #
-3	2	0	0	-1	99	4 #
-3	2	0	0	-1	99	4 #
-3	2	0	0	-1	99	4 #

1	#_env/block/dev_adjust_method (1=standard; 2=logistic trans to keep in base parm bounds; 3=standard w/ no bound check)
```

Tag loss and Tag reporting parameters go next
0 # TG_custom: 0=no read; 1=read if tags exist
-6 6 1 1 2 0.01 -4 0 0 0 0 0 0 0 #_placeholder if no parameters

1 #_Variance_adjustments_to_input_values
#_fleet: 1 2 3 4 5 6 7 8 9 10
0.036251 0 0 0.19632 -0.049828 0.01 0 0.64 0 0 #_add_to_survey_CV
0 0 0 0 0 0 0 0 0 0 #_add_to_discard_stddev
0 0 0 0 0 0 0 0 0 0 #_add_to_bodywt_CV
0.69 0.75 0.73 1 0.69 0.96 1 1 1 2.5 #_mult_by_lencomp_N
1 1 1 1 1 0.75 1 1 1 1 #_mult_by_agecomp_N
1 1 1 1 1 1 1 1 1 1 #_mult_by_size-at-age_N

6 #_maxlambdaphase
0 #_sd_offset

lambda settings to match the 2007 model
56 # number of changes to make to default Lambdas (default value is 1.0)
lambdas
Like_comp codes: 1=surv; 2=disc; 3=mnwt; 4=length; 5=age; 6=SizeFreq; 7=sizeage; 8=catch; 9=init_equ_catch;
10=recrdev; 11=parm_prior; 12=parm_dev; 13=CrashPen; 14=Morphcomp; 15=Tag-comp; 16=Tag-negbin; 17=F_ballpark
#like_comp fleet/survey phase value sizefreq_method

survey

1	1	1	1.0	1
1	2	1	0.0	1
1	3	1	0.0	1
1	4	1	0.0	1
1	5	1	1.0	1
1	6	1	1.0	1
1	7	1	0.0	1
1	8	1	1.0	1
1	9	1	0.0	1

1	10	1	1.0	1

length comps

4	1	1	0.1	1
4	2	1	0.1	1
4	3	1	0.1	1
4	4	1	1.0	1
4	5	1	0.1	1
4	6	1	0.1	1
4	7	1	0.0	1
4	8	1	0.0	1
4	9	1	0.0	1
4	10	1	1.0	1

age comps

5	1	1	1.0	1
5	2	1	1.0	1
5	3	1	1.0	1
5	4	1	0.0	1
5	5	1	1.0	1
5	6	1	1.0	1
5	7	1	0.0	1
5	8	1	0.0	1
5	9	1	0.0	1
5	10	1	0.0	1

init equ catch

9	1	1	0.0	1
9	2	1	0.0	1
9	3	1	0.0	1
9	4	1	0.0	1
9	5	1	0.0	1
9	6	1	0.0	1
9	7	1	0.0	1
9	8	1	0.0	1

9	9	1	0.0	1
9	10	1	0.0	1

parameter priors

11	1	1	0.0	1
11	2	1	0.0	1
11	3	1	0.0	1
11	4	1	0.0	1
11	5	1	0.0	1
11	6	1	0.0	1
11	7	1	0.0	1
11	8	1	0.0	1
11	9	1	0.0	1
11	10	1	0.0	1

parameter dev

12	1	1	1.0	1

crush penalty

13	1	1	100.0	1

F ball park

17	1	1	0.0	1
17	2	1	0.0	1
17	3	1	0.0	1
17	4	1	0.0	1

0 # (0/1) read specs for more stddev reporting

999

Appendix 1: Population numbers at age by year and sex (in 1000s)

Females

Time	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1890	20908	17817	15183	12938	11025	9395	8006	6822	5813	4954	4221	3597	3065	2612	2226	1897	1616	1377	1174	1000	852	4912
1891	20908	17817	15183	12938	11025	9395	8006	6822	5813	4954	4221	3597	3065	2612	2226	1897	1616	1377	1174	1000	852	4912
1892	20908	17817	15183	12938	11025	9395	8006	6822	5813	4954	4221	3597	3065	2612	2226	1897	1616	1377	1174	1000	852	4912
1893	20889	17817	15183	12938	11023	9388	7990	6799	5787	4928	4197	3576	3047	2596	2212	1885	1606	1369	1166	994	847	4881
1894	20872	17801	15183	12938	11023	9387	7985	6787	5768	4907	4177	3557	3030	2581	2199	1874	1597	1361	1159	988	842	4852
1895	20858	17786	15169	12938	11023	9387	7985	6784	5759	4892	4160	3540	3015	2568	2188	1864	1588	1353	1153	983	837	4825
1896	20846	17774	15156	12926	11023	9388	7986	6785	5758	4886	4149	3527	3002	2556	2177	1854	1580	1346	1147	977	833	4800
1897	20837	17764	15146	12915	11013	9388	7987	6787	5761	4886	4145	3519	2991	2545	2167	1846	1572	1340	1141	973	829	4776
1898	20829	17756	15138	12906	11004	9380	7988	6789	5763	4889	4146	3516	2985	2537	2159	1838	1566	1334	1136	968	825	4753
1899	20823	17749	15131	12899	10997	9373	7982	6791	5766	4893	4150	3518	2984	2533	2153	1832	1559	1328	1131	964	821	4732
1900	20818	17744	15125	12893	10991	9367	7976	6786	5769	4897	4154	3523	2986	2532	2150	1827	1554	1323	1127	960	818	4713
1901	20813	17740	15121	12888	10986	9361	7970	6780	5764	4897	4155	3525	2988	2533	2148	1823	1550	1319	1123	956	814	4691
1902	20807	17736	15117	12885	10982	9356	7964	6773	5757	4891	4154	3524	2989	2534	2148	1822	1546	1314	1118	952	811	4668
1903	20800	17730	15113	12882	10978	9352	7959	6767	5749	4883	4147	3522	2987	2533	2148	1821	1544	1310	1114	948	807	4643
1904	20792	17724	15109	12878	10976	9349	7955	6760	5741	4874	4139	3514	2984	2531	2146	1820	1542	1308	1110	943	803	4617
1905	20783	17718	15104	12875	10973	9346	7950	6755	5734	4866	4130	3506	2976	2527	2143	1817	1541	1306	1107	940	799	4589
1906	20774	17710	15098	12870	10969	9343	7947	6750	5727	4858	4121	3497	2968	2519	2139	1814	1538	1304	1105	937	795	4559
1907	20764	17703	15092	12865	10965	9340	7944	6745	5721	4851	4113	3488	2959	2511	2131	1810	1535	1301	1103	935	793	4530
1908	20754	17694	15085	12860	10961	9336	7939	6740	5715	4844	4105	3479	2950	2502	2123	1802	1530	1298	1100	933	791	4501
1909	20743	17686	15078	12854	10956	9332	7935	6735	5709	4837	4097	3471	2941	2494	2115	1795	1523	1293	1097	930	788	4472
1910	20731	17676	15071	12848	10951	9327	7929	6728	5701	4828	4087	3461	2931	2484	2106	1786	1515	1286	1092	926	785	4441
1911	20715	17665	15063	12842	10946	9321	7922	6719	5690	4816	4075	3449	2920	2473	2095	1776	1506	1278	1085	921	781	4407
1912	20698	17653	15053	12835	10940	9315	7915	6709	5678	4802	4061	3436	2907	2460	2083	1765	1496	1269	1077	914	776	4371
1913	20679	17638	15042	12827	10934	9309	7907	6698	5665	4787	4046	3420	2892	2447	2071	1753	1486	1259	1068	906	769	4331
1914	20659	17622	15030	12818	10927	9303	7899	6688	5651	4772	4029	3404	2876	2432	2057	1741	1474	1249	1058	898	762	4286
1915	20637	17604	15016	12807	10919	9296	7891	6677	5638	4756	4012	3386	2859	2416	2042	1728	1462	1238	1049	889	754	4238
1916	20613	17585	15001	12795	10909	9288	7882	6666	5624	4740	3995	3368	2841	2399	2027	1713	1449	1226	1038	879	745	4186
1917	20570	17565	14985	12782	10898	9273	7859	6634	5587	4702	3957	3332	2808	2368	1999	1689	1427	1207	1021	865	732	4108
1918	20487	17529	14968	12768	10883	9249	7814	6565	5505	4617	3876	3258	2741	2308	1946	1643	1387	1173	992	839	710	3975
1919	20405	17458	14937	12753	10871	9235	7789	6521	5441	4542	3800	3186	2675	2250	1894	1597	1347	1138	962	813	688	3842
1920	20375	17388	14876	12727	10861	9237	7809	6547	5457	4540	3784	3163	2650	2224	1870	1574	1327	1120	946	799	676	3764
1921	20343	17362	14817	12676	10839	9228	7807	6558	5473	4547	3777	3145	2627	2200	1847	1552	1307	1101	929	785	663	3684
1922	20328	17335	14795	12625	10796	9213	7808	6571	5497	4575	3796	3150	2622	2189	1833	1539	1293	1089	917	774	654	3621
1923	20320	17322	14772	12606	10753	9178	7800	6578	5515	4602	3825	3171	2631	2189	1827	1530	1284	1079	908	765	646	3566
1924	20298	17315	14761	12587	10736	9138	7760	6555	5502	4599	3832	3182	2636	2186	1818	1518	1271	1066	896	754	636	3498
1925	20275	17297	14755	12577	10720	9123	7724	6518	5479	4585	3826	3185	2643	2189	1815	1509	1260	1055	885	744	626	3430
1926	20242	17277	14739	12573	10711	9106	7704	6476	5435	4553	3802	3169	2636	2187	1811	1501	1248	1042	872	732	615	3353

1927	20177	17249	14722	12558	10704	9087	7663	6420	5357	4474	3738	3117	2595	2158	1789	1481	1228	1021	852	713	598	3244
1928	20135	17193	14699	12544	10692	9084	7657	6404	5331	4430	3692	3080	2567	2136	1776	1472	1219	1010	840	701	586	3160
1929	20100	17158	14651	12523	10679	9072	7654	6399	5319	4410	3657	3044	2537	2113	1759	1461	1211	1003	831	691	576	3082
1930	20070	17128	14621	12483	10661	9061	7645	6399	5318	4403	3643	3017	2509	2091	1741	1449	1204	998	826	684	569	3012
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1986	13564	2655	52174	2772	542	1359	1642	5495	1456	664	288	2861	311	2124	233	190	441	270	272	173	80	408
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1991	11559	7101	13870	11420	5349	5385	904	14655	634	102	219	234	713	176	77	32	315	34	228	25	20	173
1992	7330	9849	6044	11758	9459	4193	3927	623	9727	410	65	137	146	442	109	48	20	194	21	140	15	119
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1995	4647	4394	14210	4519	5989	3525	6203	4327	1660	1376	201	2978	121	19	39	41	124	30	13	6	54	82
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2002	6900	6322	1621	65863	9232	1350	1579	1323	1142	3262	891	1006	515	808	525	193	156	22	328	13	2	42
2003	12388	5880	5386	1380	55896	7780	1130	1316	1100	948	2707	739	834	427	670	436	160	129	19	272	11	37
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2006	2289	1599	2052	7658	3632	3323	850	34333	4771	692	806	674	581	1658	452	511	261	410	267	98	79	207
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Males																						
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1931	20028	16403	13425	10990	8996	7366	6014	4901	3989	3241	2633	2139	1738	1416	1153	938	762	619	503	408	332	1449
1932	19980	16369	13405	10971	8978	7342	6003	4894	3982	3236	2627	2132	1731	1406	1145	932	758	616	500	406	330	1439
1933	19977	16329	13377	10955	8962	7329	5987	4889	3981	3236	2628	2132	1729	1404	1140	928	756	614	499	405	329	1433
1934	19996	16326	13345	10932	8949	7316	5977	4877	3979	3237	2630	2135	1731	1404	1139	925	753	613	499	405	329	1430
1935	20008	16342	13343	10905	8930	7305	5966	4868	3969	3235	2630	2135	1733	1405	1139	924	750	611	497	404	329	1426
1936	20012	16352	13355	10903	8909	7290	5957	4859	3961	3226	2628	2135	1733	1406	1139	924	750	608	495	403	328	1423
1937	20039	16356	13364	10914	8907	7273	5946	4854	3957	3223	2623	2136	1735	1408	1142	926	750	609	494	402	328	1422
1938	20069	16377	13367	10920	8915	7271	5932	4846	3953	3220	2621	2133	1736	1410	1144	928	752	610	495	401	327	1421
1939	20099	16402	13384	10923	8921	7279	5932	4836	3947	3218	2620	2132	1735	1412	1146	930	754	611	495	402	326	1420
1940	20120	16426	13404	10937	8923	7283	5938	4835	3938	3212	2617	2130	1733	1410	1147	931	756	613	496	402	327	1419
1941	20144	16443	13425	10954	8935	7286	5943	4841	3939	3206	2614	2129	1733	1409	1146	933	757	614	498	404	327	1419
1942	20172	16463	13438	10971	8949	7297	5946	4847	3946	3209	2611	2128	1733	1410	1147	933	759	616	500	405	328	1420
1943	20227	16486	13455	10983	8965	7312	5961	4856	3957	3221	2619	2131	1736	1414	1150	936	761	619	503	408	331	1427
1944	20255	16531	13473	10995	8971	7318	5964	4858	3955	3222	2621	2131	1733	1412	1150	935	761	619	503	409	331	1429
1945	20202	16554	13508	11006	8971	7304	5943	4831	3928	3193	2598	2112	1716	1395	1137	925	753	612	498	405	329	1416
1946	20016	16510	13525	11029	8963	7272	5888	4766	3858	3127	2536	2060	1673	1358	1104	899	731	595	484	393	320	1378
1947	19896	16358	13490	11044	8988	7277	5877	4739	3823	3087	2497	2023	1642	1332	1081	878	715	582	473	385	313	1350
1948	19835	16260	13367	11019	9008	7311	5900	4751	3822	3077	2482	2005	1623	1317	1068	866	704	573	466	379	308	1332
1949	19818	16211	13287	10920	8993	7338	5942	4785	3846	3089	2485	2002	1617	1309	1061	861	698	567	462	376	305	1321
1950	19790	16197	13247	10854	8909	7320	5957	4811	3866	3103	2489	2000	1611	1301	1052	853	692	561	456	371	302	1307
1951	19721	16174	13235	10819	8850	7243	5930	4809	3874	3106	2489	1994	1601	1289	1040	841	682	553	448	364	296	1285
1952	19621	16118	13215	10808	8817	7187	5856	4775	3860	3101	2482	1986	1590	1276	1026	828	669	542	440	357	290	1258
1953	19597	16036	13170	10794	8814	7171	5826	4733	3849	3106	2492	1992	1593	1275	1023	822	663	536	435	352	286	1239
1954	19547	16016	13103	10756	8798	7160	5802	4696	3804	3087	2487	1993	1592	1272	1018	816	656	529	428	347	281	1216
1955	19505	15975	13087	10701	8767	7149	5796	4680	3778	3053	2474	1991	1594	1273	1017	813	652	524	423	342	277	1196
1956	19371	15941	13052	10684	8710	7102	5757	4643	3733	3003	2422	1959	1574	1259	1005	802	642	514	413	333	269	1161
1957	19304	15831	13025	10656	8702	7066	5733	4628	3719	2982	2395	1928	1558	1252	1001	798	637	509	408	328	265	1136
1958	19170	15777	12934	10632	8671	7042	5682	4584	3683	2949	2359	1891	1521	1228	985	788	628	501	401	321	258	1101
1959	19063	15667	12890	10558	8654	7023	5670	4550	3655	2926	2338	1867	1494	1201	969	777	621	495	395	316	253	1071
1960	19012	15580	12801	10524	8599	7018	5666	4554	3641	2916	2330	1858	1482	1186	952	768	616	492	392	313	250	1049
1961	18950	15538	12729	10452	8572	6974	5662	4550	3643	2903	2320	1851	1475	1176	940	755	608	488	390	311	248	1028
1962	18994	15488	12696	10397	8524	6973	5655	4578	3670	2933	2335	1864	1486	1183	943	754	605	488	391	312	249	1023

1963	19043	15523	12656	10371	8481	6937	5658	4577	3697	2959	2361	1878	1498	1194	951	757	605	486	392	314	251	1021
1964	18977	15563	12683	10334	8448	6880	5599	4546	3663	2950	2356	1877	1491	1189	947	754	600	479	385	310	249	1007
1965	15678	15510	12717	10357	8422	6861	5564	4511	3650	2934	2359	1881	1498	1189	947	754	600	478	382	306	247	1000
1966	14139	12813	12672	10384	8439	6836	5544	4478	3617	2920	2342	1881	1498	1192	946	753	600	477	380	303	243	991
1967	24109	11556	10467	10340	8437	6807	5468	4401	3533	2841	2286	1829	1466	1167	927	735	586	466	371	295	236	958
1968	29192	19704	9438	8536	8387	6780	5411	4304	3437	2742	2196	1761	1407	1126	895	711	563	448	357	284	226	914
1969	21979	23858	16097	7703	6942	6781	5445	4320	3419	2720	2165	1730	1386	1106	884	703	558	442	352	280	223	894
1970	26745	17963	19494	13144	6276	5637	5485	4390	3474	2744	2180	1734	1385	1109	884	707	562	446	353	281	224	892
1971	8537	21858	14676	15915	10703	5089	4550	4410	3518	2777	2190	1738	1381	1102	882	703	562	447	355	281	224	887
1972	7771	6977	17859	11984	12970	8692	4117	3667	3544	2821	2224	1752	1389	1103	880	704	561	449	356	283	224	886
1973	52916	6351	5700	14579	9757	10517	7009	3302	2930	2822	2242	1764	1388	1100	873	696	557	444	355	282	224	878
1974	5794	43247	5187	4648	11830	7852	8380	5525	2580	2273	2179	1725	1354	1064	842	668	532	425	339	271	215	841
1975	39988	4735	35315	4228	3767	9493	6227	6568	4283	1983	1737	1658	1308	1025	804	635	503	401	321	255	204	795
1976	3016	32681	3867	28792	3429	3027	7548	4899	5121	3313	1526	1331	1267	997	780	611	483	383	305	243	194	758
1977	5231	2465	26689	3153	23343	2754	2405	5929	3813	3956	2544	1166	1014	963	757	592	463	366	290	231	184	720
1978	8703	4276	2013	21767	2560	18809	2199	1903	4657	2976	3075	1969	900	781	741	582	455	356	281	222	177	694
1979	24184	7113	3493	1643	17699	2070	15104	1754	1509	3677	2342	2413	1542	704	610	578	454	355	277	219	173	679
1980	5372	19765	5809	2848	1333	14239	1648	11912	1372	1172	2842	1803	1852	1181	538	466	442	346	270	211	167	649
1981	3370	4390	16140	4732	2305	1068	11274	1290	9237	1056	897	2166	1370	1404	894	407	352	333	261	204	159	615
1982	1064	2754	3586	13152	3821	1843	845	8835	1003	7141	813	688	1658	1047	1071	681	310	268	254	199	155	589
1983	4508	870	2250	2922	10630	3050	1458	663	6892	779	5524	627	530	1274	804	822	523	238	205	194	152	570
1984	71926	3685	710	1834	2364	8495	2408	1143	517	5354	603	4269	484	409	981	619	632	402	183	158	149	555
1985	3116	58783	3009	579	1479	1875	6629	1856	875	394	4065	457	3226	365	308	739	466	476	302	137	119	529
1986	13564	2547	48001	2450	466	1170	1459	5092	1412	663	297	3061	343	2421	274	231	553	349	356	226	103	484
1987	10502	11085	2080	39084	1973	369	912	1123	3880	1069	500	224	2301	258	1816	205	173	414	261	267	169	439
1988	18575	8583	9053	1695	31561	1570	289	707	863	2966	814	380	170	1745	195	1376	155	131	314	197	202	460
1989	19123	15181	7008	7368	1362	24878	1214	220	532	645	2207	604	282	126	1290	144	1016	115	97	232	146	488
1990	8333	15629	12395	5705	5922	1072	19159	919	165	395	476	1621	443	206	92	943	105	742	84	71	169	463
1991	11559	6811	12760	10092	4596	4678	829	14579	691	123	293	352	1197	326	152	68	694	78	546	62	52	465
1992	7330	9446	5561	10391	8130	3635	3619	630	10920	513	91	215	258	875	239	111	49	507	57	398	45	377
1993	19583	5990	7715	4535	8414	6498	2859	2802	482	8278	386	68	161	193	654	178	83	37	378	42	297	314
1994	5156	16005	4893	6293	3680	6747	5131	2226	2153	367	6267	291	51	121	145	490	133	62	28	283	32	458
1995	4647	4214	13072	3991	5106	2958	5348	4014	1723	1653	280	4767	221	39	92	109	370	101	47	21	214	370
1996	4445	3798	3441	10657	3233	4089	2335	4155	3079	1309	1248	210	3571	165	29	68	82	276	75	35	16	435
1997	3113	3633	3102	2805	8630	2587	3227	1817	3191	2342	989	938	158	2671	123	22	51	61	206	56	26	336
1998	17697	2545	2967	2527	2269	6886	2031	2493	1386	2404	1750	735	694	116	1967	91	16	37	45	151	41	266
1999	106653	14463	2078	2419	2050	1823	5470	1595	1940	1070	1846	1338	560	528	88	1493	69	12	28	34	115	233
2000	2233	87165	11814	1695	1965	1653	1457	4336	1256	1520	836	1436	1039	434	409	68	1155	53	9	22	26	268
2001	7418	1825	71212	9643	1378	1589	1329	1166	3455	998	1205	661	1135	820	343	323	54	911	42	7	17	232
2002	6900	6063	1491	58134	7847	1116	1281	1067	933	2758	795	959	526	902	652	272	256	43	723	33	6	198
2003	12388	5639	4954	1218	47413	6383	905	1037	863	753	2226	641	773	424	727	525	219	206	35	583	27	164

2004	2827	10124	4609	4049	995	38741	5215	740	847	705	615	1818	524	631	346	594	429	179	169	28	476	156
2005	1877	2310	8273	3764	3305	812	31599	4252	603	690	574	501	1481	427	514	282	484	349	146	137	23	515
2006	2289	1534	1888	6758	3074	2699	663	25793	3470	492	563	468	409	1208	348	420	230	395	285	119	112	439
2007	7236	1871	1254	1543	5520	2510	2203	541	21040	2830	401	459	382	333	985	284	342	188	322	232	97	449
2008	6428	5913	1529	1024	1259	4504	2048	1797	441	17157	2308	327	374	311	272	803	231	279	153	262	189	445
2009	44185	5253	4832	1249	836	1028	3675	1670	1465	360	13985	1881	267	305	254	222	654	189	227	125	214	517
2010	30654	36111	4293	3948	1019	682	837	2991	1358	1191	292	11361	1528	216	248	206	180	531	153	185	101	593
2011	6927	25053	29509	3506	3221	831	554	680	2428	1102	966	237	9208	1238	175	201	167	146	431	124	150	563
2012	8947	5661	20472	24100	2861	2625	676	451	552	1971	894	783	192	7469	1004	142	163	135	118	349	101	577
2013	23684	7312	4626	16719	19664	2332	2137	550	366	449	1600	726	636	156	6059	815	115	132	110	96	283	550
2014	34880	19356	5975	3778	13636	16015	1896	1735	446	297	363	1296	588	515	126	4905	659	93	107	89	78	674
2015	18905	28507	15817	4879	3082	11115	13039	1542	1410	362	241	295	1052	477	418	102	3981	535	76	87	72	610

Appendix 2:

Coastwide Pre-Recruit Indices for select *Sebastes* species from SWFSC and NWFSC/PWCC Midwater Trawl Surveys (2001-2014)

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Introduction

This document provides an update of coastwide pre-recruit indices of abundance developed for past stock assessment cycles (Ralston 2010, Sakuma and Ralston 2012), using data collected during SWFSC, NWFSC and PWCC/NWFSC midwater trawl surveys for young-of-the-year (YOY) pelagic juvenile groundfish. For the last two assessment cycles, these indices have been developed with guidance from the 2006 Pre-Recruit Survey Workshop (Hastie and Ralston 2007), such that data collected by these different surveys using identical gear and methods could be pooled to develop "coastwide" indices of abundance for YOY *Sebastes* spp. (see Sakuma et al. 2006, Ralston et al. 2013 and Ralston and Stewart 2013 for reviews of data, methods, vessel comparison and select results). This was in recognition that the data collected over a longer time period (1983-present) from the "core" area of the SWFSC survey were likely to present a biased and/or imprecise representation of YOY abundance due to significant interannual shifts in the spatial distribution of pelagic juvenile YOY (Ralston and Stewart 2013). However, variable ship availability and survey effort make the development of truly "coastwide" indices for some years impossible.

Data Analysis

In order to balance the need to develop indices that reflect coastwide abundance with the temporal and spatial availability of data, particularly given previous strong differences in relative catch rates around the major biogeographic boundaries in the California Current (Ralston and Stewart 2013), we used years with the most comprehensive coverage to evaluate the spatial scope appropriate for each individual stock for which an index might be developed. Figure 1 shows haul locations for the different surveys over time, for the SWFSC (1983-2014, fixed stations), NWFSC (2011, 2013-2014, fixed stations) and PWCC/NWFSC (no fixed stations) datasets. Table 1 shows the total number of hauls by 2° latitude bins (the reported latitude in the Table represents the "mean" latitude for that bin, such that latitude 46 includes hauls from 45°-47° N) for all of the survey data when pooled together. As the years 2004-2009 and 2013-2014 included very comprehensive coastwide coverage (albeit with very little data north of 47°N), these years were used to develop "climatologies" of the spatial distribution of the catch, in order to evaluate where the majority of the catch by species took place, so that "coastwide" indices could be crafted for southerly and northerly distributed species as appropriate. This time period included years of very high (2009, 2013-2014) as well as very low (but spatially variable, 2005-

2007) abundance, and thus should provide a reasonable characterization of the expected spatial distributions of most species.

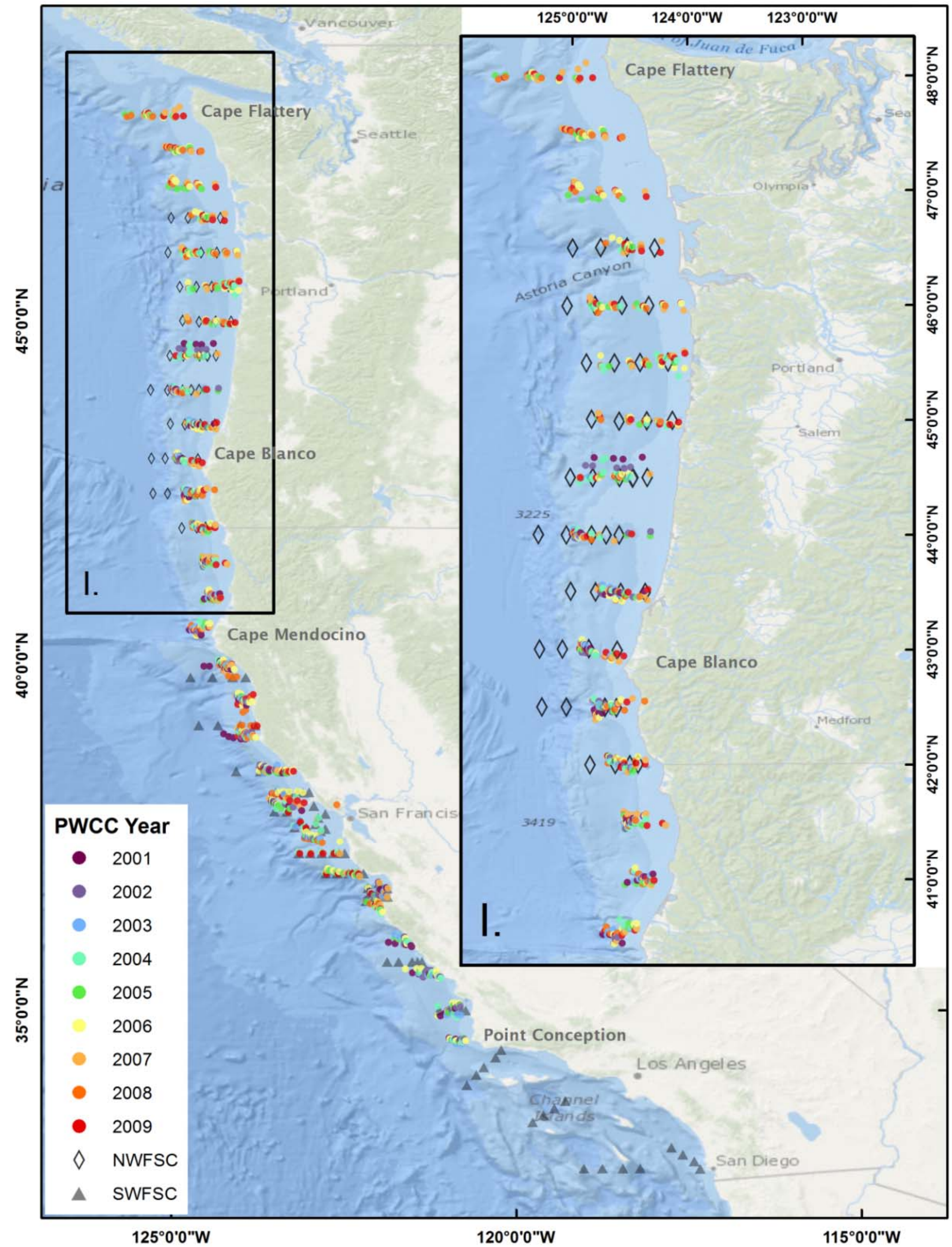

Figure 1: Station and haul locations for SWFSC, NWFSC and PWCC/NWFSC midwater trawl surveys.

Table 1: Number of hauls by year and latitude bin, with data used to develop mean climatologies of spatial abundance (to evaluate the areas necessary for a "coastwide" index) in boxes.

- only northern species
- all species
- only southern species

year	latitude bin 32	34	36	38	40	42	44	46	48	Total
1983			15	29						44
1984			17	34						51
1985			22	66	8					96
1986			40	84						124
1987			61	80						141
1988			63	71						134
1989			47	53						100
1990			62	74						136
1991			66	54						120
1992			50	45						95
1993			48	53						101
1994			46	49						95
1995			45	49						94
1996			45	49						94
1997			39	46						85
1998			42	48						90
1999			44	46						90
2000			44	53						97
2001		6	70	58	22	19	19			194
2002		6	66	52	19	21	17			181
2003		8	73	71	21	22	19			214
2004	8	29	76	74	28	20	27	22		284
2005	13	27	93	62	35	17	22	21	12	302
2006	14	24	84	86	41	21	20	22	13	325
2007	11	17	78	85	37	25	22	23	16	314
2008	13	20	43	43	37	21	22	18	15	232
2009	7	19	59	79	30	24	23	23	16	280
2010	6	15	44	52	16					133
2011			29	30	20	22	27	24	13	165
2012	3	13	51	27						94
2013	7	21	51	39	17	17	21	13		186
2014	5	13	54	57	16	15	18	9		187
Total	87	218	1667	1798	347	244	257	175	85	4878

The results of the exploration of catch rate climatologies indicated that some fairly rational generalizations could be made regarding the spatial survey extent that might represent "coastwide" coverage for the different species of rockfish. Specifically, for the "northern" species, widow rockfish (*S. entomelas*), yellowtail rockfish (*S. flavidus*), black rockfish (*S. melanops*), blue rockfish (*S. mystinus*), and canary rockfish (*S. pinniger*), the data from the years of the best truly coastwide coverage indicate that 99.7 to 100% of population abundance, as measured by spatial integration of average catch-per-unit-effort (fish·tow^{-1}), has occurred within the 36 - 46° N latitudinal bins (Table 2, Figure 2; representing effort between 35 and 47° N). Thus, the best spatial coverage for these species are in the years for which data from that entire area are available, limiting the effective coastwide indices for these species to the years 2004-2009, 2011 and 2013-2014. However, as this excludes several early years of the time series for which spatial coverage was not unreasonable (2001-2003, 2010), and one of these years is believed to be a fairly strong recruitment year for a number of species (2010), we also prepared indices for widow, yellowtail, and canary rockfish for a more limited spatial extent (36-44° N), both to contrast with indices with greater spatial coverage, as well as to provide an indicator of whether the better temporal coverage was consistent with observed strong year classes that are or will be emerging from the assessment models.

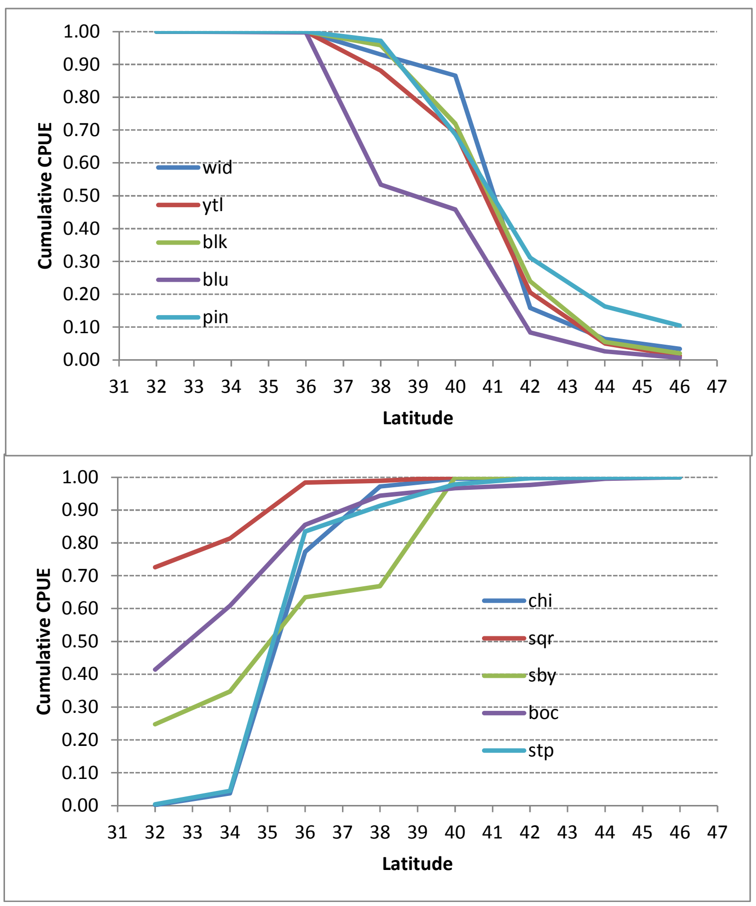

Figure 2: Cumulative CPUE for northern (top) and southern (bottom) rockfish species, showing the relative importance of different areas.

Similarly, for the "southern" species, chilipepper rockfish (*S. goodei*), squarespot rockfish (*S. hopkinsi*), shortbelly rockfish (*S. jordani*), bocaccio (*S. paucispinis*), and stripetail Rockfish (*S. saxicola*), between 97 and 100% of the integrated abundance took place within or below the 40° latitude bin (e.g., latitudes 41° and south); with most of the catch of chilipepper, squarespot rockfish, and bocaccio within the range of 32 to 38° N. Note that for bocaccio and shortbelly rockfish, the 32°N bin was particularly important, with over 40% of bocaccio abundance and 25% of the shortbelly rockfish aggregate CPUE coming from this region (despite relatively thin sampling effort), and over 60% and 40% of the abundance of these species (respectively) from the 32° and 34° N bins. These, not surprisingly, coincide with the area of greatest abundance and historical catch of bocaccio (and greatest abundance of shortbelly rockfish), and led to the

Table 2: Relative CPUE by 2° latitude bins for the species of primary interest. Green denotes the effective "coastwide" distribution, pink denotes areas of low catch, yellow denotes species not reported.

NORTHERN SPECIES

Species	32	34	36	38	40	42	44	46	% CPUE
wid	0.00	0.02	2.43	2.24	24.77	3.31	1.06	1.17	**99.9%**
ytl	0.00	0.00	0.89	1.41	3.63	1.16	0.28	0.09	**100.0%**
blk	0.00	0.00	0.07	0.40	0.79	0.31	0.06	0.03	**100.0%**
blu	0.01	0.02	5.29	0.86	4.28	0.65	0.23	0.07	**99.7%**
pin	0.00	0.00	0.13	1.26	1.66	0.66	0.26	0.46	**100.0%**

SOUTHERN SPECIES

Species	32	34	36	38	40	42	44	46	% CPUE
chi	0.04	0.84	17.25	4.67	0.56	0.04	0.07	0.00	**97.0%**
sqr	23.24	2.81	5.46	0.16	0.35	0.00	0.00	0.00	**98.9%**
sby	57.76	23.22	66.95	7.97	77.07	0.07	0.10	0.05	**99.9%**
boc	1.04	0.49	0.62	0.22	0.06	0.03	0.05	0.01	**94.3%**
stp	0.06	0.62	12.00	1.19	1.00	0.27	0.04	0.01	**97.9%**

decision to constrain the estimates for these species to those years that included the 32-34 latitude bins up through 40°N (e.g., 2004-2010, 2012-2014). By contrast, the region of greatest abundance of adult and juvenile chilipepper is central California, so the chilipepper index was developed using the 2001-2014 data (excluding 2011). Due to time constraints and the absence of assessment models, no indices were developed for squarespot or stripetail rockfish, although past analyses and the raw catch rate data suggests similar trends to those observed for the other three southern species.

Prior to developing the Pre-Recruit index, the raw catch rate data were converted to standard age fish, due to substantial interannual variation in the size distribution of fish collected. To accomplish this, the length of each specimen of a species in a haul was converted to an estimated age using a linear regression of age $N = \boldsymbol{a} + \boldsymbol{b} \times SL$, where N is estimated age in days and SL is standard length (mm). Data used to fit all species-year regressions were generated by sub-sampling fish and counting daily otolith increments (see Woodbury and Ralston 1991). The contribution of each fish in a given haul was then age-adjusted according to:

$$N^{*}_{h,t} = N_{h,t} \exp[-M(100 - t_{hat}]$$

Where N^{*} is the number of fish in 100 day old equivalents, $N_{h,t}$, is the number of fish from haul h of estimated age t and M is the natural mortality rate of pelagic juvenile rockfish (0.04 day^{-1}; see Ralston and Howard 1995, Ralston et al. 2013). Standardized abundances were obtained by summing the number of 100 day old equivalent fishes within a haul. This effectively standardizes the contribution of all fish to a common age of 100 d, i.e., younger fish are down-weighted and older fish are up-weighted. The number of age observations for each species is shown in Table 3. Note that sample sizes vary over time, and in particular sample sizes are very low since the early 2000s as a result of the considerable resources necessary for developing the age data. Also note that with the exception of a small number of fish from 2004 through 2014, virtually all data were from the historical "core" area (e.g., approximately 36-38° N). An analysis of spatial differences in widow rockfish growth rates by a 2014 Hollings Scholar (L. Mowczan, with N. Kashef, unpublished data) from both the core and from northern (OR, WA) areas in 2013 suggests that growth rates vary modestly but significantly over space within years. Greater effort is needed to better quantify any both temporal and spatial differences in growth.

With respect to very short term (daily) and consequent interannual variability, Crane (2014) aged a substantial number of YOY widow, yellowtail and chilipepper rockfish from the 1990s through 2008 to evaluate environmental effects on growth rates. She used daily growth increment anomalies and an autoregressive multiple regression model to explore the role of environmental parameters at very fine temporal scales. She found that a combination of sea surface temperature and ecosystem productivity (e.g., upwelling) indices accounted for ~ 5 to 33% of the overall interannual variability in growth rates. Given the difference in regional as well as interannual SSTs and other oceanographic factors, it is likely greater differences in growth rates exist over the combined axes of time and space. In the future, a hierarchical growth model with species, year and spatial effects may be the optimal means of parameterizing the growth functions.

Table 3: Number of age observations available for growth models by species.

year	widow	yellow-tail	chili-pepper	square-spot	short-belly	black	blue	boca-ccio	canary	stripe-tail	total
1983					30						30
1984			2		52			50		12	116
1985	25	18	36		41		17	19			156
1986	9	8	25		29		9	36	32		148
1987	45	23	72	22	46		19	83	21	30	361
1988	49	24	74		91		27	53			318
1989	23	49	14		54	1	15	22			178
1990	28	29	48	24	24		19	27			199
1991	35	31	33		31		22	32	24	32	240
1992		5	10		18		4	1			38
1993	23	21	31		26		15	28			144
1994	14	6	7		25		8	1			61
1995	14	9	14		7		7	2			53
1996			3		12			1			16
1997	27		21		25		11	7			91
1998	4	3			14						21
2001	34	32	36	17	39		24	29	25		236
2003	27		22		29		27		22		127
2004	11		5		13	1	10	2	1	1	44
2005			11								11
2006		1									1
2007	12		6								18
2008	24	14	7								45
2012					9						9
2013	33		10		6			16			65
2014								14			14
Total	437	273	487	63	621	2	234	423	125	75	2740

ANOVA Index

Following discussions during the 2006 Pre-Recruit Survey Workshop related to the strengths and weaknesses of alternative analytical approaches, indices distributed to stock assessment authors in recent assessment cycles (Ralston 2010, Sakuma and Ralston 2012) have been based on an ANOVA index, primarily because of its ability to best account for significant year x latitude interactions, and we continue this practice here. The specific form of the ANOVA mixed model is:

$$\log(C_{i,j,k,l,m,n} + 1) = Y_i \times L_j + Z_k + D_l + V_m + \varepsilon_{i,j,k,l,m,n}$$

with all independent variables treated as categorical. Specifically Y_i is a fixed year effect $\{Y_i \in 2001, 2002, \ldots, 2013, 2014\}$, L_j is a fixed latitudinal effect $\{L_j \in 32, 34, \ldots, 46\}$, Z_k is a fixed depth effect {$Z \leq 160$ m or $Z > 160$ m}, D_l is a fixed calendar date effect {$D_l \in 120, 130, \ldots, 170$}, V_m is a random vessel effect [$V_m \sim N(0,\sigma_v)$], and $\varepsilon_{i,j,k,l,m,n}$ is normal error term [$\varepsilon \sim N(0,\sigma_\varepsilon)$] for the n^{th} observation in a stratum. As in the past, the interactions between latitude and year were explicitly modeled, with specific year, latitude combinations of data used for each species as described previously. The model was fit to the data using PROC MIXED (SAS Institute Inc. 2004) and the year × latitude parameter estimates were bias-corrected, integrated over latitude, and error estimates summarized in a manner directly analogous to the traditional ANOVA approach.

Note that vessel effects were modeled as random effects for the NOAA R/V *David Starr Jordan* (2001-2008), the F/V *Excalibur* (2001-2009, 2011) and the NOAA R/V *Miller Freeman* in (2009), as all these vessels surveyed in the 36-40°N latitudinal range when deployed, including multiple nights of paired (side-by-side) trawling between the F/V *Excalibur* and the two NOAA ships (see Sakuma et al. 2006), which allowed estimation of the fishing power of the three ships. However, since 2010 only a single vessel has been used each year; the F/V *Frosti* in 2010 (SWFSC), the F/V *Excalibur* in 2011 (both SWFSC and NWFSC), the NOAA R/V *Bell M. Shimada* in 2012 (SWFSC) and the R/V *Ocean Starr* (formerly the NOAA R/V *David Starr Jordan*, but operated by Stabbert Maritime and contracted for this survey) in 2013 and 2014 (SWFSC and NWFSC). Hence, for most of these recent years, given that a new vessel was deployed in a year with no other ships with which to compare its performance, vessel effects could not be estimated independently from the year effect, resulting in those vessel effects shrinking to the mean of the distribution.

In addition, a 10-d calendar date or "period" effect was defined to account for the seasonal change in availability of YOY rockfish to midwater trawling. The distribution of trawls by period are reported in Table 4. Note that this includes the distribution of trawling effort by period from 2001-2014 inclusive, recognizing that the precise sample size would vary for any individual species based on their distribution and the years and areas used in the index. Finally, a bottom depth effect was defined, with trawling activity distributed on and off the continental shelf (defined by the 160 meter isobath). A total of 1779 (57.6%) trawls were conducted offshore of the shelf break, and 1311 (42.4%) inshore of the shelf break.

The crossed year and latitudinal effects from the mixed model were summed over latitudes and the year-specific estimates of integrated catch rate (CPUE) were back-transformed (antilogged) to the arithmetic scale with bias-correction, i.e., exp(effect + mse/2). Similarly, the variance terms for the logged values were summed, and the variance associated with the estimate on log-scale (s_0^2) was used to calculate the CV of the estimate on arithmetic scale according to: $CV = \text{sqrt}\{\exp(s_0^2) - 1\}$ (Johnson and Kotz 1970), which was then used to calculate the variance of the back-transformed estimates. The means and variances were then and its variance obtained in a manner directly analogous to the traditional ANOVA approach. Lastly, the total variance was expressed as a CV of the catch rate statistic.

Table 4: Number of trawls by period (for calendar date effects)

Start	End	Period	Trawls
30-Apr	9-May	12	292
10-May	19-May	13	950
20-May	29-May	14	735
30-May	8-Jun	15	682
9-Jun	18-Jun	16	316
19-Jun	28-Jun	17	89
29-Jun	4-Jul	18	26

Results

Results for the northern species, including those from both the best spatial and the best temporal coverage, are presented in Table 5 and Figure 3, with Figures in log scale to make visual comparisons possible. Note that as with previous analyses in both the historical core area (Ralston et al. 2013) and in the extended survey area (Ralston and Stewart 2013), there is considerable covariance in abundance among all five species over this time period. Recruitment in general was strong in 2002 and 2004, poor from 2005 through 2008, and increased from 2009 through 2014, with data indicating very high recruitment in 2013 and 2014 for most species. Similarly, the indices developed with the best spatial and the best temporal coverage respectively (for widow, yellowtail, and canary rockfish) suggest very comparable trends in the years for which estimates overlap, with R^2 values for the overlapping years for each species range from 0.77 to 0.97 (in both log and arithmetic space). This suggests that the use of the longer time series (i.e., best temporal coverage) is reasonable to consider. Alternatively, this may provide some basis for better evaluating the extent to which the estimated recruitments in these indices are comparable with the estimated recruitments from stock assessments, in which the indices might be considered appropriate. However, one unusual result of the temporally extended index is the relatively low value for the index in 2010 for widow and yellowtail, as very high numbers of pelagic YOY of these species were observed in July of 2010 by the SWFSC juvenile salmon survey. High values were also observed for canary rockfish and the southern rockfish species.

Results for the three southern species (Table 6, Figure 4) presented here also indicate positive temporal covariation and trends comparable to those for the Northern Species, including the very strong recruitments observed in 2010 and 2013-2014. Strong recruitment in 2009 and 2010 has been confirmed by other recruitment indices, as well as length composition data from recreational fisheries and from surveys (Field 2013), and there is growing evidence from these same data sources, as well as anecdotal observations, that 2013 will also be a strong year class. For both regions, the general results based on the random effects model for vessel effects are essentially unchanged from previous analyses (Ralston 2010, Sakuma and Ralston 2012).

Table 5: ANOVA Pre-Recruit index results for spatially and temporally rich models of northern rockfish species

	Spatially Rich					Temporally Rich				
					Widow Rockfish					
Year	est	var	mse	antilog	CV	est	var	mse	antilog	CV
2001						1.05	0.18	0.69	4.02	0.44
2002						2.84	0.19	0.69	24.02	0.45
2003						1.48	0.18	0.69	6.18	0.44
2004	4.30	0.36	0.54	96.44	0.66	2.21	0.17	0.69	12.91	0.43
2005	2.65	0.37	0.54	18.45	0.67	0.23	0.16	0.69	1.78	0.42
2006	1.19	0.36	0.54	4.29	0.66	-0.04	0.16	0.69	1.35	0.41
2007	1.05	0.35	0.54	3.72	0.65	0.02	0.16	0.69	1.44	0.42
2008	2.02	0.38	0.54	9.88	0.67	1.04	0.18	0.69	4	0.44
2009	1.76	0.36	0.54	7.60	0.66	0.85	0.17	0.69	3.31	0.43
2010						0.8	0.41	0.69	3.15	0.71
2011	2.00	0.39	0.54	9.66	0.69	0.76	0.21	0.69	3.01	0.48
2013	6.94	0.96	0.54	1350	1.27	2.89	0.41	0.69	25.41	0.71
2014	5.32	0.87	0.54	267.7	1.18	2.04	0.41	0.69	10.85	0.71
					Canary Rockfish					
2001						0.60	0.04	0.26	2.09	0.20
2002						2.08	0.04	0.26	9.14	0.21
2003						0.31	0.04	0.26	1.56	0.20
2004	3.01	0.09	0.21	22.59	0.31	1.41	0.04	0.26	4.66	0.19
2005	1.68	0.09	0.21	5.97	0.31	0.07	0.03	0.26	1.22	0.19
2006	1.16	0.09	0.21	3.53	0.30	-0.11	0.03	0.26	1.02	0.18
2007	1.31	0.09	0.21	4.12	0.30	0.27	0.03	0.26	1.49	0.18
2008	1.58	0.10	0.21	5.38	0.32	0.52	0.04	0.26	1.91	0.20
2009	1.43	0.09	0.21	4.62	0.31	0.48	0.04	0.26	1.85	0.19
2010						1.76	0.07	0.26	6.64	0.28
2011	2.35	0.10	0.21	11.63	0.33	0.85	0.05	0.26	2.66	0.23
2013	1.68	0.22	0.21	5.93	0.50	0.65	0.07	0.26	2.20	0.28
2014	2.11	0.19	0.21	9.14	0.46	0.48	0.07	0.26	1.85	0.27
					Yellowtail rockfish					
2001						0.21	0.08	0.31	1.44	0.28
2002						0.61	0.08	0.31	2.15	0.29
2003						0.57	0.08	0.31	2.06	0.28
2004	2.70	0.17	0.28	17.11	0.44	1.61	0.07	0.31	5.81	0.27
2005	0.91	0.18	0.28	2.87	0.44	0.05	0.07	0.31	1.22	0.27
2006	0.31	0.17	0.28	1.56	0.43	0	0.07	0.31	1.17	0.26
2007	0.13	0.17	0.28	1.30	0.43	-0.04	0.07	0.31	1.12	0.27
2008	0.83	0.18	0.28	2.65	0.45	0.7	0.08	0.31	2.36	0.28
2009	0.63	0.17	0.28	2.16	0.44	0.49	0.07	0.31	1.91	0.27
						0.41	0.17	0.31	1.76	0.44
2011	0.71	0.19	0.28	2.35	0.46	0.4	0.09	0.31	1.75	0.31
2013	2.73	0.46	0.28	17.60	0.76	1.67	0.17	0.31	6.17	0.44
2014	2.84	0.41	0.28	19.70	0.71	1.87	0.17	0.31	7.61	0.43
					Best Spatial Coverage Only					
	Black Rockfish					Blue Rockfish				
2004	1.94	0.05	0.09	7.27	0.22	2.57	0.30	0.44	16.32	0.59
2005	0.81	0.05	0.09	2.36	0.22	1.35	0.31	0.44	4.80	0.60
2006	0.40	0.05	0.09	1.56	0.22	0.22	0.30	0.44	1.55	0.59
2007	0.36	0.05	0.09	1.51	0.22	0.23	0.30	0.44	1.57	0.59
2008	0.73	0.05	0.09	2.17	0.23	0.16	0.31	0.44	1.47	0.61
2009	0.49	0.05	0.09	1.71	0.22	0.36	0.30	0.44	1.79	0.59
2011	0.53	0.05	0.09	1.78	0.23	1.26	0.32	0.44	4.40	0.62
2013	0.23	0.12	0.09	1.32	0.36	5.54	0.80	0.44	318	1.11
2014	0.50	0.11	0.09	1.72	0.34	2.51	0.73	0.44	15.41	1.03

Table 6: ANOVA Pre-Recruit index for southern rockfish species

year	sumest	sumvar	mse	backtran	CV
Bocaccio					
2004	0.38	0.04	0.15	1.58	0.19
2005	0.67	0.03	0.15	2.12	0.17
2006	0.07	0.03	0.15	1.15	0.17
2007	0.26	0.03	0.15	1.40	0.19
2008	0.19	0.03	0.15	1.30	0.18
2009	0.43	0.05	0.15	1.66	0.23
2010	0.74	0.06	0.15	2.27	0.24
2012	0.06	0.07	0.15	1.15	0.28
2013	1.53	0.05	0.15	4.97	0.23
2014	0.66	0.06	0.15	2.08	0.25
Shortbelly Rockfish					
2004	1.27	0.26	1.00	5.89	0.55
2005	3.80	0.21	1.00	74.00	0.49
2006	0.18	0.20	1.00	1.98	0.47
2007	1.57	0.24	1.00	7.90	0.52
2008	0.84	0.24	1.00	3.82	0.52
2009	3.41	0.37	1.00	49.76	0.67
2010	2.24	0.41	1.00	15.45	0.71
2013	11.02	0.36	1.00	100279	0.66
2014	8.07	0.45	1.00	5265	0.75
Chilipepper					
2001	0.49	0.21	0.65	2.26	0.48
2002	1.33	0.21	0.65	5.22	0.49
2003	0.53	0.18	0.65	2.36	0.44
2004	0.97	0.12	0.65	3.64	0.36
2005	0.00	0.12	0.65	1.38	0.36
2006	0.09	0.12	0.65	1.52	0.36
2007	0.00	0.14	0.65	1.39	0.38
2008	0.29	0.14	0.65	1.84	0.39
2009	0.70	0.15	0.65	2.80	0.40
2010	1.44	0.28	0.65	5.86	0.57
2012	0.68	0.30	0.65	2.74	0.59
2013	5.62	0.27	0.65	383	0.56
2014	3.63	0.28	0.65	52.19	0.57

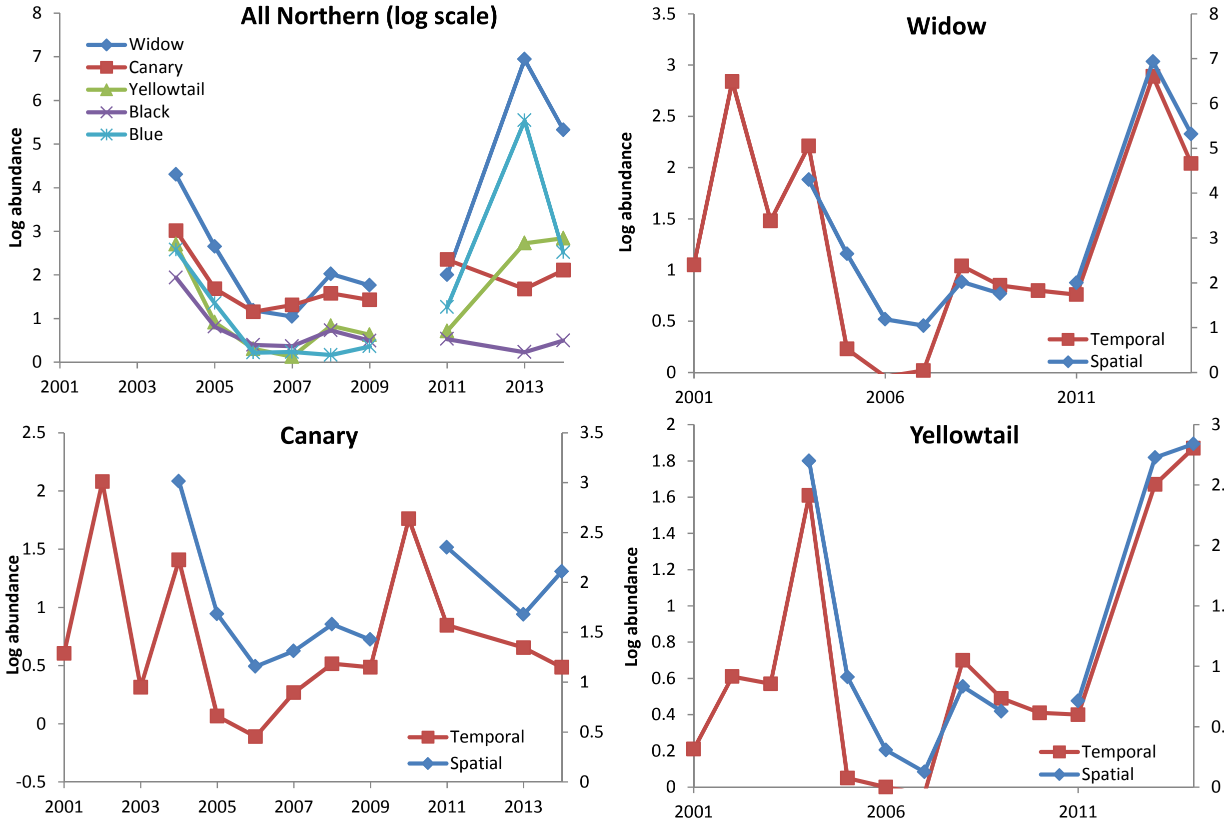

Figure 3: All northern species indices (in log scale), and the spatially and temporally rich indices for Widow, Canary and Yellowtail Rockfish.

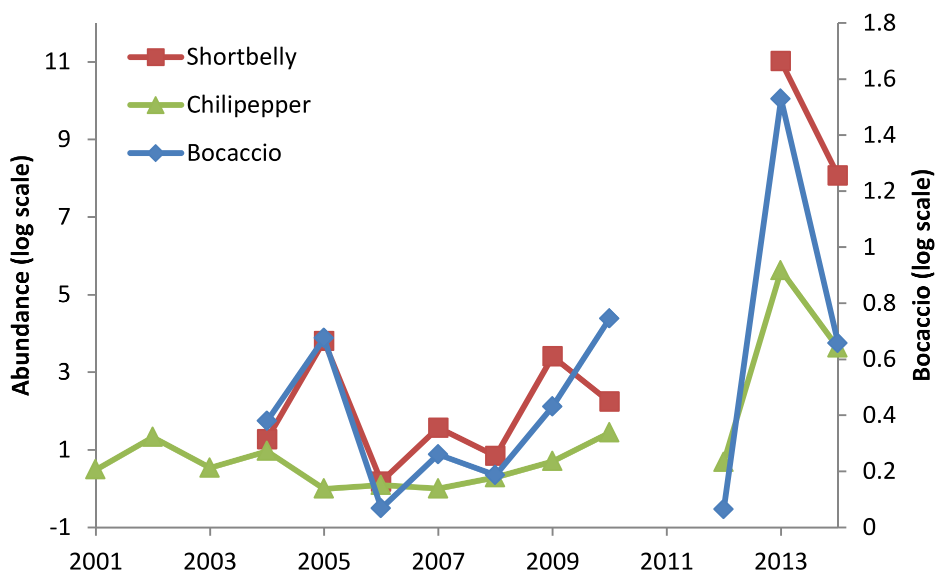

Figure 4: All southern species indices (in log scale).

Discussion and Future Directions

Although analyses of the coastwide data continue to be associated with difficult questions regarding appropriate spatial scale and the trade-off between adequate spatial and temporal coverage, the observation that recent years strongly appear to be associated with above average to very high recruitment for most species is encouraging. Given that these results are also consistent with previously reported observations of strong covariability among species (Ralston et al. 2013), an observation also made with respect to realized recruitments from stock assessment models (Thorson et al. 2012, Ralston et al. 2013, Stachura et al. 2014), there is reason to be optimistic regarding recruitment trends for the 2013-2014 period. These results might suggest that some exploration into the potential for a generalized recruitment index, either on a coastwide or regional basis, would be worthwhile for future efforts. For example, Thorson et al. (2012) developed what might be a conceptual model for such an index based on a meta-analysis of recruitments for data-rich species that could inform data-poor species.

Ralston et al. (2013) also found that with respect to variability in pelagic juvenile rockfish abundance, the best predictive variable was relative sea level (an indicator of meridional, or alongshore, transport), also a result consistent with a meta-analysis of recruitment estimates from age-structured stock assessments (Stachura et al. 2014). Efforts to improve our understanding of the physical processes responsible for YOY groundfish distribution and abundance continue to evolve, most recently using a data-assimilative Regional Ocean Model System (ROMS) of the California Current, which has already been used to explore environmental correlates to krill and juvenile rockfish abundance (Schroeder et al. 2014). Currently, a workshop that would bring together SWFSC and NWFSC survey teams, assessment analysts and oceanographers to evaluate coastwide abundance data, distribution patterns and linkages to both empirical and ROMS based environmental data is anticipated, but will not take place until after the 2015 assessment cycle.

The magnitude of the variability is also interesting; the index in arithmentic scale for Bocaccio only represents a roughly fourfold increase in abundance from the lowest to the highest year, yet the adult population exhibits some of the strongest variability in recruitment in the California Current. By contrast, the shortbelly rockfish index between the lowest and highest index years represents a range of over five orders of magnitude; variability that has not been evident in past stock assessments or age composition data from recent surveys. These observations suggest that past discussions regarding the role of post-settlement density dependent processes, which are widely recognized for marine fishes and have been documented in the California Current (Adams and Howard 1996, Hobson et al. 2001, Johnson 2006) are worth additional future consideration when considering how such indices should be incorporated into stock assessments.

References

Adams, P.B. and D.F. Howard. 1996. Natural mortality of blue rockfish, *Sebastes mystinus*, during their first year in nearshore benthic habitats. Fishery Bulletin 94:156-162.

Crane, K.E. 2014. Environmental effects of growth of early life stages of rockfishes (*Sebastes*) of Central California based on analysis of otolith growth patterns. MS Thesis, Humboldt State University.

Field, J.C. 2013. Status of bocaccio, *Sebastes paucispinis*, in the Conception, Monterey and Eureka INPFC areas as evaluated for 2013. Stock Assessment and Fishery Evaluation. Pacific Fishery Management Council: Portland, Ore.

Hastie, J. and S. Ralston. 2007. Pre-recruit survey workshop, September 13-15, 2006, Southwest Fisheries Science Center, Santa Cruz, California, 23 p.

Hobson, E. S., J. R. Chess, and D. F. Howard. 2001. Interannual variation in predation on first-year *Sebastes* spp. by three northern California predators. Fishery Bulletin 99: 292-302

Johnson, N. L. and S. Kotz. 1970. Continuous univariate distributions Part 1, Distributions in Statistics, John Wiley & Sons, New York, 300 p.

Johnson, D.W. 2006. Predation, habitat complexity, and variation in density-dependent mortality of temperate reef fishes. Ecology 87: 1179-1188.

Ralston, S. and D. F. Howard. 1995. On the development of year-class strength and cohort variability in two northern California rockfishes. Fishery Bulletin 93:710-720.

Ralston, S. 2010. Coastwide Pre-recruit indices from SWFSC and NWFSC/PWCC midwater trawl surveys (2001-2010). FED/SWFSC.

Ralston, S., K.M. Sakuma and J.C. Field. 2013. Interannual variation in pelagic juvenile rockfish abundance– going with the flow. *Fisheries Oceanography* 22: 288–308.

Ralston, S., and I. Stewart. 2013. Anomalous distributions of pelagic juvenile rockfish on the U.S. West Coast in 2005 and 2006. *CalCOFI Reports* 54: 155-166.

Sakuma, K.M. and S. Ralston. 2012. Coastwide pre-recruit indices from midwater trawl surveys (2001-2012). Appendix in Field (2013) bocaccio stock assessment update. http://www.pcouncil.org/groundfish/stock-assessments/by-species/bocaccio-rockfish/

Sakuma, K.M., S. Ralston, and V.G. Wespestad. 2006. Interannual and spatial variation in the distribution of young-of-the-year rockfish (*Sebastes spp.*): expanding and coordinating a survey sampling frame. *CalCOFI Reports* 47: 127-139.

SAS Institute Inc. 2004. SAS/STAT® 9.1 User's Guide. SAS Institute Inc., Cary, NC.

Schroeder, I.D., JA. Santora, E.L. Hazen, S.J. Bograd, J. Fietcher, C.A. Edwards, J.C. Field and B.K. Wells. 2014. Application of a data-assimilative regional ocean modeling system for assessing California Current System ocean conditions, krill, and juvenile rockfish. *Geophysical Research Letters* 41: doi:10.1002/2014GL061045.

Stachura, M.M., T.E. Essington, N.J. Mantua, A.B. Hollowed, M.A. Haltuch, P.D. Spencer, T.A. Branch and M.J. Doyle. 2014. Linking Northeast Pacific recruitment synchrony to environmental variability. Fisheries Oceanography 23: 389-408.

Thorson, J.T., I.J. Stewart, I.G. Taylor and A.E. Punt. 2013. Using a recruitment-linked multispecies stock assessment model to estimate common trends in recruitment for US West Coast groundfishes. Marine Ecology Progress Series 483: 245-256.

Woodbury, D. P., and S. Ralston. 1991. Interannual variation in growth rates and back-calculated birthdate distributions of pelagic juvenile rockfishes (*Sebastes* spp.) off the central California coast. Fishery Bulletin 89: 523-533.